ON SOME NEW AND RARE HYDROIDA IN THE AUSTRALIAN MUSEUM COLLECTION.

By W. M. Bale, F.R.M.S.

(Plates XII.-XXI).

The species of Hydroida treated of in the present paper were (with one exception) included in a collection sent to me by Dr. Ramsay, from the Australian Museum, about the end of the year 1886. Besides a number of new species there were represented several which had previously been very imperfectly known, for one of which—the *Ceratella fusca* of Gray—I have found it necessary to constitute a new family. Among the other specimens were a number of Dr. von Lendenfeld's types of the species described by him in the Linnean Society's Proceedings, several of which prove to be identical with species previously known. I have to thank Mr. T. Whitelegge, of the Australian Museum, for forwarding me additional specimens of some of the species, and also for notes of his examination of some of those in the Museum.

The type specimens from Dr. von Lendenfeld's collection, include the following—the references being to the Proceedings of the Linnean Society of N.S. Wales, Vol. IX.

Sertularella microgona, von Lendenfeld.

P.L.S.N S.W. IX., p. 416, Pl. VII., figs. 1-3. (See page 763).

Diphasia symmetrica, von Lendenfeld.

l.c. p. 414, Pl. VIII., fig. 7.

This is identical with *Sertularia bispinosa*, Gray.

SERTULARIA FERTILIS, von Lendenfeld.

l.c. p. 406, Pl. VII., figs. 4-5.

This supposed species is founded on specimens of a Thuiaria (*T. sub-articulata*, Coughtrey), from which the brittle hydrothecæ have been broken away. The portions figured as hydrothecæ are not really such, but only the projecting portions of the hydrocaulus on which they have been supported, and the apparent teeth on the outer margins are merely remnants of the front of the hydrotheca, which are frequently left adhering when the rest of the cell is lost. I figure on Plate XVIII., fig. 8, a fragment of one of Dr. von Lendenfeld's type specimens, in which one of the hydrothecæ is preserved. I have another specimen from New Zealand, differing from Dr. von Lendenfeld's in the much lighter colour, and in this also most of the hydrothecæ are lost or injured.

Professor Allman describes *T. sub-articulata* (under the name of *T. bidens*) as having two teeth on the inner side of the hydrotheca and the rest of the margin smooth, while Mr. Coughtrey says that there are two teeth on the outer side, in addition to the inner two. The outer teeth are present in all the cells which I have seen, but it is often difficult to distinguish more than one tooth on the inner side.

PLUMULARIA GRACILIS, von Lendenfeld.

l.c. p. 476, Pl. XIV., fig. 17 ; Pl. XVII., figs. 28-29.

The type is a specimen of *P. Ramsayi*, Bale. Neither the detailed figure nor the description agrees with the specimen, which does not possess a mesial sarcotheca *above* the hydrotheca on the same internode, as represented.

PLUMULARIA RUBRA, von Lendenfeld.

l.c. p. 476, Pl. XIII., figs. 11-12; Pl. XIV., fig. 15. (See page 778).

PLUMULARIA TORRESIA, von Lendenfeld.

l.c. p. 477, Pl. XIII., figs. 13, 14 ; Pl. XIV., fig. 16 ; *P. campanula*, Busk. (See page 776).

PLUMULARIA TRIPARTITA, von. Lendenfeld.

l.c. p. 477, Pl. XII., figs. 8-10. = *P. setacea*, Ellis. (See page 778).

PENNARIA ROSEA, von Lendenfeld.

l.c. p. 594, Pl. XXIV., figs. 40-42.

This species is, as Mr. Whitelegge has pointed out to me, identical with the *P. australis* of the Catalogue of the Australian Hydroid Zoophytes. I have described this species as having 7-12 filiform tentacles, and 9-14 capitate ones, while *P. rosea* is stated to have 30-40 and 20-30 respectively. The discrepancy (especially in the number of the filiform tentacles) is very great. and I cannot account for it. I have examined many hydranths (including terminal ones) both from my original specimens and from Dr. von Lendenfeld's types, and have not succeeded in finding any with a larger number of tentacles than I have recorded, except in one or two cases where the number of capitate tentacles reached about 17. Mr. Whitelegge has kindly examined a number of specimens with the same result. The figure which accompanies Dr. von Lendenfeld's description shows a hydranth with not more than 10 or 12 capitate tentacles. I have not found the proboscis or oral portion separated from the rest of the body so sharply as shown by Dr. von Lendenfeld.*

P. australis is very closely allied to *P. symmetrica*, Clarke, the polypary especially so ; but the hydranths of *P. symmetrica* are ovate, not flask-shaped, and have about 30 capitate and 14-18 filiform tentacles.

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*Dr. von Lendenfeld has a note, to which reference is wanting, at the foot of the page containing his description of *P. rosea*, referring to page 45 of the "Catalogue" (the description of *P. australis*) ; it is evident, therefore, that he intended at first to refer his specimens to that species, where they undoubtedly belong.

OBELIA AUSTRALIS, von Lendenfeld.

l.c. p. 604. (See page 753).

DIPHASIA RECTANGULARIS, von Lendenfeld.

l.c. p. 914, Pl. XLI., figs. 6-8.

This is synonymous with *Idia pristis*, Lamx. Fig. 7 shows part of a pinna with the hydrothecæ separated, but there is nothing of the kind in the type specimens, which are quite similar to that figured in the "Catalogue." The gonothecæ also agree with my former specimens, and not with Dr. von Lendenfeld's figure.

EUCOPELLA CAMPANULARIA, von Lendenfeld.

(See page 751).

A few other species were represented, but the specimens were too fragmentary, or not sufficiently well preserved, to be of much value.

CERATELLIDÆ.

Hydranths naked, sessile on processes of a chitinous reticulated polypary, tentacles all capitate, scattered irregularly over the body. Gonosome unknown.

CERATELLA FUSCA, Gray.

Hydrophyton forming a much ramified compressed structure, resembling a Gorgonian coral; polypary chitinous, of a dark brown colour, and of a finely reticulated structure, the main stem finally becoming very thick and irregular in form; branches gradually smaller towards the ends, very numerous and crowded: hydrophores (bracket-like projections of the hydrocaulus, which support the hydranths) arranged in a somewhat irregular sub-spiral manner round the branches, formed by slightly radiating ribs united by perforated laminæ, the ribs projecting at the outer margin; meshes of the polypary filled with cœnosarc. Hydranths ovate, sessile

on the hydrophores, erect, armed with a number (about 8 or 10) of short capitate tentacles, which are scattered over the body without definite order.

Additional localities — Off Port Jackson Heads: Broughton Islands.

Mr. Brazier has already recorded in the Proceedings of the Linnean Society of N. S. Wales for 1886, page 575, the occurrence of *C. fusca* (not previously recognized since its original discovery by Gray) at various localities near Sydney, including Bondi Bay, where it was first obtained. Mr. Whitelegge informs me that it is found on Laminaria-roots.

From examination of a specimen which had been preserved in spirit, I find that the hydranths are not formed on the same type as those of *Hydractinia* (in which there is a single circle of filiform tentacles surrounding the base of a conical proboscis), but are armed with capitate tentacles only, which are distributed irregularly over the body. *Ceratella* must therefore be removed from the Hydractiniidæ, to which family it was assigned by Mr. Carter, in the absence of the hydranths, and must form the type of a new family—the CERATELLIDÆ—allied to the Corynidæ by the structure of the hydranths, and to the Hydractiniidæ by their sessile condition and by the character of the polypary. This however is not quite the same as in *Hydractinia*, being distinguished by its free and erect growth, as well as by other peculiarities. The basis of the structure (as seen in the new extensions at the ends of the branches), is a reticulated chitinous tissue, so like the skeleton of some of the horny sponges that a portion broken off and examined separately might well be mistaken for sponge-tissue. As growth proceeds this substance becomes denser and closer, and the superficial fibres in some parts usually run parallel, so as to leave channels between them. This is especially the case with the under side of the projections on which the hydranths are supported, to which I have applied the term "hydrophores," originally used by Professor Allman for the calycles of *Halecium*. These are formed by a number of longitudinal ribs which run along the

branch for some distance, and are continued outwards in a bracket-like form, spreading somewhat apart and united by chitinous matter which forms a sort of web with numerous perforations, so that the outer or lower side of the hydrophore presents the aspect of a number of channels bounded by the ribs, and having perforated or reticulated floors. On the upper side of the hydrophore further reticulations exist. When the polypary with the cœnosarc is examined by reflected light the whole mesh of the polypary is seen to be filled with the whitish cœnosarc, with the edges of the superficial fibres everywhere showing as a fine brown reticulation. The hydranths are stout ovate bodies like those of the genus *Coryne*, very little narrowed below, and seated directly on the hydrophore. I found a difficulty in counting the exact number of tentacles, owing to the specimens being imperfectly preserved, but there appeared to be usually about eight or ten, four or five of which generally surrounded the oral extremity, while the others were variously scattered over the body, one or two being often found quite close to the base. The capitula are large and globular, with such short stems that they appear almost sessile, but this may be caused by the contraction of the tentacles after death. The cœnosarc contains numerous thread-cells, somewhat similar to those of *Hydra*, but larger.

The polypary generally attains a height of about three inches, and is sometimes slender throughout, and beset with hydrophores for most of its extent, but in other cases the stem and principal branches are very thick and without hydrophores. Doubtless as the organism increases in growth the older portions become enveloped in fresh layers of cœnosarc, covering the hydrophores and forming a thick trunk as in the ordinary fascicled hydroids. The newly-formed terminal portions of the branches are compressed in a plane at right angles to that of the whole polypary.

EUCOPELLINÆ.

Eucopella campanularia, von Lendenfeld.

(Plate XIII., figs. 9-15).

This hydroid is no less remarkable for the structure of the trophosome than for the nature of the medusan gonozooid. I received portions of two gatherings, both from Bondi, but differing considerably in the form of the hydrothecæ. The hydrorhiza is remarkably broad, with a much thickened perisarc, giving off branches at right angles. The peduncles, which vary from the length of a hydrotheca to four or five times as long, are straight, and very thick and massive; but the perisarc is thinned away at the base down to its junction with the hydrorhiza, at which point the external diameter of the peduncle is but little more than that of the cavity which runs through it. The peduncle is rounded off at its summit, at which part the cœnosarcal tube is somewhat enlarged, as it is also at the base. A single spherule intervenes between the hydrotheca and the peduncle.

The hydrothecæ are remarkable among the Campanularians by their bilateral symmetry. Those of the variety which corresponds most closely with the type specimens are, as seen in their broader diameter, semi-ovate, with one of the narrower sides cut down a little lower than the opposite one, and the broader sides elevated. The margin is not everted nor toothed. There is no cavity corresponding to the external shape of the calycle, but the interior is filled up with a solid chitinous mass, leaving only a wide shallow depression at the top, and a narrow tubular passage to the base of the calycle. The hydranth is therefore not retractile, but rests on the calycle, which furnishes a slightly concave support for it. The solid part of the calycle is clear and transparent, yellowish in colour, and almost homogeneous. In the other variety the calycles are similarly solidified, but the lower part appears as if condensed and shrunken; and the transparent homogeneous structure has given place to a woody-looking

tissue, with irregular superficial ridges running from the base upwards. The two narrow sides of the calycle-margin are curved outwards, so as to form thick solid everted lips, one of which is higher than the other.

In Dr. von Lendenfeld's type specimens some of the hydrothecæ are more deeply excavated, and he states that deep-water specimens have thick hydrothecæ, while those from the harbour have thin ones. The specimens which I have described are, however, from the harbour.

CAMPANULARIIDÆ.

Obelia geniculata, Linn.

Additional locality.—Middle Harbour, Port Jackson.

Obelia angulosa, n.sp.

(Plate XII., fig. 3).

Hydrocaulus monosiphonic, 1-2 inches in height, usually with numerous sub-erect branches given off from the main stem; stem and branches more or less zig-zag, with a few rings or spiral turns (mostly 3-5) just above the origin of each peduncle; peduncles ringed, those on the upper portions of the hydrophyton consisting of 2-4 rings, those on the lower portions often twice the length of the calycle, usually having the central part smooth; hydrothecæ alternate, funnel-shaped, generally slightly constricted at the level of the "floor," which is some distance above the base, and situated somewhat obliquely; margin slightly everted, not toothed, somewhat uneven.

Gonothecæ urn-shaped, mostly very long and slender, with an elevated neck; peduncle with about 3-5 rings; upper part of the capsule often marked with faint, not prominent rings. Ova variable in number (often about 15), in two or three rows, or irregularly arranged. Gonozooids not observed.

Hab.—Parramatta River.

This species is found growing in tufts, the largest of which among my specimens is about 1½ inch high. Branches are given off, sometimes profusely, from the main stem, but no secondary branchlets were to be found, though possibly such might be produced on older specimens. Each internode of the hydrocaulus springs from a point immediately below the origin of a hydrotheca-peduncle, forming a rather sharp curve upwards; and the upper part of the internode is very slightly curved outwards in the opposite direction, so that the stem or branch acquires a slightly zig-zag form. Thus instead of the peduncle of the hydrotheca being given off at an angle with the stem-internode which bears it, the peduncle is continuous with its internode in a direct line, and the next internode springs off at an angle. The hydrotheca when immature is entire, the summit being crowned with a watch-glass-shaped cap, which ultimately falls off, leaving the margin of the hydrotheca rather irregular or ragged-looking. The rings of the hydrocaulus are very distinct and regular, sometimes spiral, at other times simply annular. When the peduncles of the calycles are longer than would be equal to the width of nine or 10 rings, the central part is smooth. The gonangia are remarkable for the length they usually attain, compared with their small diameter, being often less in width than an average calycle, and more than three times its length.

Obelia australis, von Lendenfeld.

(Plate XII., figs. 1-2).

Primary shoots monosiphonic, about 1-1½ inches in height, sometimes with a few small branches, stem and branches flexuous, with a few rings or spiral turns (mostly 3-5) just above the origin of each peduncle; 8 or 10 rings usually at the base of each stem and branch; peduncles ringed, those on the upper portions of the hydrophyton consisting of about 4-10 rings, those on the lower portions longer, often with 10-20 rings, or with the central part smooth. Hydrothecæ alternate, somewhat obconical, or with the upper portion almost cylindrical; not noticeably constricted at the

level of the "floor," which is a little above the base, and situated obliquely; margin very slightly everted, not toothed, somewhat uneven.

"The gonophores have the ordinary elongate shape. . . . . At the time of liberation the medusa is similar to a newly-born *O. geniculata*." (Von Lendenfeld).

Hab.—East coast of N. Zealand, Laminarian Zone.

Dr. von Lendenfeld says of this species:—"The stem of this Obelia is creeping, adnate to foreign bodies, to which it clings like a hydrorhiza. The stem bears hydranths on very short annulated stalks, and also a few very short branches with nearly sessile hydrothecæ. These creeping stems are short, and take their origin from a distinct hydrorhiza, which differs from the creeping stem by the much greater thickness of its perisarc, and by the numerous anastomoses which cause it to attain a reteform appearance."

I have not been able to verify this description, nor distinguish the "creeping stems" from a true hydrorhiza, but in any case the stems which bear the hydranths and short branches are not the "creeping stems," but the erect shoots. Dr. von Lendenfeld refers to this species (but apparently not with absolute certainty), an adult medusa which he found in large numbers in Port Jackson. The tentacles are said to be from 30 to 40, and the umbrella always in a reverted position. This is not the case with the young medusæ which were obtained with the trophosome.*

O. australis is somewhat coarser and more rigid than *O. angulosa*. It may be distinguished from that species by the internodes of the stem, which are not abruptly curved outwards at their origin, but are more or less curved alternately in opposite directions throughout their whole length, so that the stem is flexuous. The hydrothecæ are less conical than those of *O. angulosa*, without the distinct constriction at the level of the floor, which is also nearer the base of the cell, and rather more oblique.

*On p. 920, Vol. IX., Dr. von Lendenfeld says, "I have described this species from the polyp-colonies and the young larvæ which I obtained in Port Jackson." In the original description, however, the only locality mentioned is the East coast of New Zealand.

Campanularia caliculata, Hincks.

(Plate XIII., figs. 1-3).

Two gatherings of this species have been obtained from Port Jackson, in one of which the calycles are for the most part wholly without the thickened wall which usually characterizes the species; occasionally however they conform to the type. In the other specimens, the calycles agree pretty closely with those figured by Mr. Hincks, and vary to about the same extent. The peduncles are exceedingly variable in length, sometimes being 16-18 times the length of the calycle. They may be closely undulated throughout, or almost smooth, the latter condition occurring principally in the longer peduncles. The gonangia contain two sporosacs, and are borne in extraordinary profusion, their number often greatly exceeding that of the hydrothecæ.

Campanularia caliculata, *var. makrogona*, von Lendenfeld.

(Plate XIII., figs. 4-8).

In this variety the hydrotheca-wall is thickened throughout, but more particularly at the base, and at the upper portion, where the chitinous substance forms an external band encircling the upper $\frac{1}{2}$ or $\frac{1}{3}$ of the calycle, very thick in the centre, and gradually thinned away above and below. In most of the hydrothecæ the cavity is exactly cylindrical, with a flat floor, but in some of them the internal diameter slightly diminishes downward. The margin is somewhat everted, and often becomes doubled or trebled by successive circles of growth. The peduncles are stout and usually very strongly undulated.

I am not aware whether the very large gonangia characteristic of this variety are always associated with the peculiar form of hydrothecæ which I have described; if so, it may be questioned whether there is not sufficient ground for separating this form as a distinct species.

Campanularia (?) spinulosa, n.sp.

(Plate XII., figs. 5-7).

Hydrorhiza slender, climbing; hydrocaulus about ½ inch high, slender, unbranched or with numerous sub-erect branches; stem and branches nearly straight, with a few rings or spiral turns (mostly 4-6) just above the origin of each peduncle, 6-12 rings usually at the base of each stem or branch; peducles ringed, those on the upper parts of the hydrophyton consisting of about 5-6 rings, those on the lower portions often with 8-10. Hydrothecæ alternate, sub-cylindrical in their upper half, tapering below, slightly constricted at the "floor," which is a little above the base, and somewhat oblique; margin armed with a number of minute slender compressed spines (usually 20-24) arranged in pairs, the margin very slightly sinuated between the two spines of a pair, more deeply sinuated (almost semi-circularly) between the pairs; hydrotheca marked with faint longitudinal lines, one between every two pairs of spines.

Gonosome unknown.

Hab.—Port Jackson, on a Tubularia.

In the form of the hydrothecæ, and the arrangement of their marginal teeth, this species is similar to a hydroid described by Clarke under the name of *Obelia bidentata*,* but that species is polysiphonic and grows to the height of six inches, while the specimens of *C. spinulosa*, which I have examined, are of delicate growth and not more than half an inch in height. It is possible, though perhaps not probable, that the present species is a young form of *O.* (?) *bidentata*; at present it may be provisionally regarded as distinct. Most of the shoots exhibit the rudiment of a polysiphonic structure, consisting of a delicate stolon which originates from an aperture formed at the outer side of the base of the most proximal peduncle, and grows downward along the

* Descriptions of new and rare species of hydroids from the New England coast. (Transactions of the Connecticut Academy of Arts and Sciences, Vol. III., Part I.)

original stem. When it reaches the object on which the zoophyte is growing it becomes attached thereto, and assuming the character of the hydrorhiza, gives off fresh shoots. In nearly all my specimens the downward growth of the supplemental tube was arrested by the death of the organism before it could reach the base of the stem, leaving it with an obliquely truncated extremity.

Campanularia (?) serrulata, n.sp.

(Plate XII., fig. 4).

Hydrorhiza slender, climbing; hydrothecæ borne on long peduncles, which spring either directly from the hydrorhiza or from the side of other peduncles; peduncles slender, with about 8-16 rings at the base and a less number (mostly 2 or 3) at the summit, smooth throughout the rest of their length. Hydrothecæ large, campanulate, constricted at the "floor," which is raised above the base so as to enclose a nearly cylindrical cavity; margin not expanding, armed with about 10-14 rather large, triangular, pointed teeth.

Gonosome unknown.

Hab.—Port Jackson, on a Tubularia.

This is a delicate species, with no proper stem, but the primary peduncles generally give origin to secondary ones exactly resembling them, the habit in this respect being similar to that of *C. marginata*, a species otherwise very different to the present. The rings of the peduncles are distinct and regular, as in *C. spinulosa*. The specimens were less than half an inch in height.

Campanularia costata, Bale.

Near Peel Island, Moreton Bay, parasitic on *Pasythea hexodon*. (Mr. J. D. Ogilby).

The aperture is more or less oblique in most of the specimens. Perhaps this species might best be placed in the genus Lafœa.

Campanularia marginata, Bale.

Bondi ; Coogee (plentiful), (Mr. T. Whitelegge).

I have mentioned in the "Catalogue" that some of the hydrothecæ of this species have the remains of an operculum visible, but in these specimens the structure alluded to is not present. It is a very delicate membrane, and in the few cases where I have met with it was incomplete. It may probably be a temporary structure like that which covers the immature hydrothecæ of various species of Obelia.

LAFOEIDÆ.

Lafoea scandens, n.sp.

(Plate XIII., figs. 16-19).

Hydrophyton parasitic on other hydroids ; hydrorhiza slender ; hydrothecæ springing directly from the hydrorhiza, tubular, straight or slightly curved, rounded below to the level of the "floor," basal portion short, contracted, pedicle very short ; aperture simple, margin very slightly everted, often double or triple.

Gonangia about double the length and diameter of the hydrothecæ, tapering downwards in the lower half ; with more or less distinct transverse undulations ; margin with three or four shallow emarginations ; summit of the blastostyle forming a trumpet-shaped expansion ; gonophores two, both on the same side of the blastostyle.

Hab.—Port Stephens; Port Jackson; mostly on *Sertularella divaricata*, var. *sub-dichotoma.*

The specimens of *Sertularella divaricata* from Port Stephens were quite overrun by this species, its hydrothecæ in some parts equalling or even exceeding in number those of the Sertularella. So far as I am aware, it is the first species of Laföea in which the gonosome has been observed. The gonothecæ were fairly

plentiful, and in various stages of development; those which were entire und unopened contained a slender blastostyle bearing two gonophores. The summit of the blastostyle is trumpet-shaped and apparently open, bnt no tentacles are present. The terminal portion appears to fall off before the maturity of the second gonophore; at least it was absent from those capsules from which the primary gonophore had been extruded. The gonophore seemed to contain three or four large ova grouped above a stout spadix, but the specimens were not sufficiently well preserved to place the structure beyond doubt. The aperture of the ripe gonotheca, with its three or four emarginations and corresponding opercular divisions, strongly resembles the aperture of the hydrothecæ in some species of Sertularella.

HALECIIDÆ.

Halecium gracile, n.sp.

(Plate XIV., figs. 1-3).

Hydrophyton slender, monosiphonic, attaining a height of about $\frac{3}{4}$ inch; hydrorhiza climbing over other hydroids; branches somewhat straggling, variable in length, stem and branches slightly flexuous, divided into moderately long internodes, by twisted oblique joints which slope alternately in opposite directions, each internode bearing a calycle close to its upper extremity. Calycles alternate, varying from almost tubular to funnel-shaped, and often with other calycles springing from within them; margin expanding, strongly everted; basal part of the calycle sometimes ringed.

Gonothecæ,—female, large, ovate, compressed, sporosac decidedly narrower than the capsule, with a space at the upper part not occupied by ova:—male smaller, club-shaped in outline.

Hab.—Port Stephens, on an Aglaophenia; Port Jackson, on a Tubularia.

This species differs from most others in being slender and monosiphonic. Each internode gives off primarily a single calycle,

and the branches originate at the sides of these calycles. When the soft matter is cleaned away there is usually visible a circle of puncta indicating the position of the base of the hydranth, and when a new calycle is formed within an old one it originates from this part, which is but a short distance below the margin. The base of the hydranth is usually flattened, and is united by a very slender isthmus to an offshoot of the cœnosarc which occupies the centre of the lower part of the hydrophore. Sometimes the branches are all short, and somewhat pinnately arranged, but in other specimens they are larger, occasionally equalling the stem in length.

Halecium parvulum, n.sp.

(Plate XIV., figs 4-5).

Hydrophyton about $\frac{1}{2}$ to $\frac{3}{4}$ inch high, branches ascending, stem and lower branches fascicled, stem and branches flexuous in the upper portions, divided into rather short internodes by twisted oblique joints, which slope alternately in opposite directions, each internode bearing a calycle close to its upper extremity. Calycles alternate, sub-tubular, often with other calycles springing from within them; margin expanding, strongly everted, basal part of the calycle sometimes ringed.

Gonotheca,—female, large, ovate, compressed, with a large concave notch at the summit, sporosac similar in outline to the capsule, and nearly filling it, ova completely occupying the interior of the sporosac :—male, not observed.

Hab—Bondi Bay.

In the form and arrangement of the calycles this species differs little, if at all, from *H. gracile*, but may be distinguished from that species by the compound stem and shorter internodes, as well as by the difference in the gonosome. The specimens were growing on a small sponge, and a very intimate union existed between the sponge and the hydroid, the former having grown for some distance round the basal portions of the Halecium, and the sponge-fibres being closely and firmly adherent to the latter in all

directions. Mr. Whitelegge informs me that the specimens in the Museum are all similarly attached to the same species of sponge; it is therefore probable that the association is a constant characteristic.

SERTULARIIDÆ.

SERTULARELLA DIVARICATA, *var. sub-dichotoma*, n. var.

(Plate XVI., figs. 3-4).

Hydrocaulus about 6 inches in height, straggling, ramuli similar to the stem, given off irregularly, but in the same plane; thicker portions of the hydrocaulus sometimes supporting more than one hydrotheca on an internode. Hydrothecæ tubular, adnate most of their height, free part slightly bent outwards; aperture with three teeth, the superior somewhat recurved.

Gonothecæ large, obovate, strongly annulated (9-10 rings), orifice very small, infundibulate, mostly excentric.

Hab.—Port Jackson.

The trophosome differs from that of the typical *S. divaricata* only in its habit, the ramuli being given off quite irregularly and at long intervals, while those of the type are borne, with some exceptions, below every third hydrothecæ on each side of the stem. The gonothecæ differ from those of the type simply in the small size of the orifice, which is like that commonly found in the Bass' Straits form of *S. Johnstoni*.

SERTULARELLA DIVARICATA, *var. dubia*, n. var.

(Plate XVI., figs. 1-2).

Hydrocaulus 1-2 inches high, ramuli similar to the stem, given off irregularly but in the same plane, thicker portions of the hydrocaulus sometimes supporting more than one hydrotheca on an internode. Hydrothecæ tubular, adnate most of their height, free part slightly bent outwards, aperture with three teeth, the superior somewhat recurved.

Gonothecæ large, obovate, strongly annulated, (10-12 rings), orifice rather wide, infundibulate, mostly excentric.

Hab.—Bondi Bay.

This form might with almost equal propriety be assigned either to *S. divaricata* or to the southern Australian *S. Johnstoni* (if indeed it be not, as appears likely, one of a series of transition forms uniting the two). In the bushy habit and the comparatively short internodes it rather resembles *S. Johnstoni*, but its hydrothecæ are more like those of *S. divaricata*, being adnate most of their length, and only slightly projecting forward. The peristome often consists of several successive growths. The gonothecæ are a little smaller than those of the type, with closer and more numerous rings; the aperture is precisely similar. The polypary is much shorter and more bushy than that of the variety *sub-dichotoma*, but the pinnæ or ramuli, as in that form, are given off at irregular intervals, so that the pinnate habit is lost.

Sertularella longitheca, n.sp.

(Plate XVI., figs. 5-6).

Hydrocaulus slightly branched, divided by oblique joints into internodes which bear one or occasionally two hydrothecæ. Hydrothecæ adnate from $\frac{1}{3}$ to $\frac{1}{2}$ of their length, long, narrow, tubular, smooth, curved outwards, springing from the sides of the hydrocaulus or partly from the front; aperture not contracted, with three large teeth, one superior and two lateral.

Gonothecæ rather large, without annulations, somewhat widened laterally, with a shoulder at each side of the aperture; aperture small, tubular, not expanding.

Hab.— Port Denison.

The only specimen I have seen was $2\frac{1}{2}$ inches high, and consisted of a monosiphonic stem with five or six simple lateral branches. The hydrothecæ are toothed like those of the *S. Johnstoni* group, but are nearly double as long in proportion to their diameter, while

the gonangia are of a totally distinct type. Only one of the latter was present, which was slightly distorted, so that its exact form was rather doubtful, but it appeared to have two lateral wings terminating upwards in angles at each side of the aperture.

Sertularella microgona, von Lendenfeld.

(Plate XVI., fig. 8).

Hydrocaulus simple, about $\frac{1}{5}$ inch in height, composed of long, slender internodes which are abbreviated above close to the hydrothecæ, and are undulated somewhat spirally in their lower portions. Hydrothecæ barrel-shaped, rather slender, somewhat contracted towards the aperture, with about three transverse rugæ; adnate $\frac{1}{3}$ of their height or somewhat more, directed outwards and but slightly forwards; aperture with four teeth and a four-sided operculum; three internal compressed vertical teeth, two of which are within the two upper emarginations of the border, and the third opposite the inferior marginal tooth.

Gonothecæ ?

Hab.—Port Phillip.

This species is a close ally of the *S. tenella* of Hincks, and is very slender throughout. The portions of the internodes below the hydrothecæ are slightly waved, long, and tubular, often being fully double the length of the hydrotheca. The internal teeth are three in number, and are arranged precisely as in *S. indivisa*; but as *S. microgona* has four marginal teeth, the internal ones do not alternate regularly with them, the lower one being opposite a marginal tooth, while the others are between the three upper marginal teeth. A close examination of specimens of *S. polyzonias* from Port Phillip shows that a similar arrangement exists in that species, though the internal teeth are so delicate and transparent that they are easily overlooked.

Dr. von Lendenfeld says that the gonangia of *S. microgona* are without rings, but his outline figure shows them transversely wrinkled.

Sertularella variabilis, n.sp.

(Plate XV., figs. 5-9).

Hydrocaulus simple or pinnate, pinnæ when present alternate, given off just below each hydrotheca on the stem; stem and pinnæ divided by twisted joints into internodes, each bearing a hydrotheca on its upper part. Hydrothecæ adnate from $\frac{1}{3}$ to $\frac{1}{2}$ their height, divergent, both series directed towards the front or all nearly in the same plane, with several more or less distinct transverse rugæ, contracted near the aperture and swollen below; aperture with three marginal teeth, one superior and two lateral, also with three internal compressed vertical teeth alternate with those of the margin, or sometimes with three teeth within the lowest side and one within each of the other two sides.

Gonothecæ ovate, with transverse undulations which vary greatly in number and distinctness, and are often absent from the proximal part; summit tubular, with from two to six teeth, and a small circular aperture.

Hab.—Bondi; Coogee.

With some hesitation, I include under the name of *S. variabilis* a series of forms allied to (and partly intermediate between) the *S. indivisa* and *S. solidula* of the southern coast. The form which may be regarded as the type differs from *S. indivisa* mainly in having the internodes and hydrothecæ stouter and comparatively shorter, so that for the most part each hydrotheca is nearly or quite in contact with the lower part of the next internode above, while in *S. indivisa* the internodes are slender and elongated, with the joints consisting usually of double oblique constrictions, so that the hydrothecæ are more widely separated. The hydrothecæ in the present form are also larger, and both series are commonly, but not invariably, directed towards the front, instead of lying in the same plane. The other principal type represented in the collection seems more apt to assume the pinnate form, and would not be suspected of any very close affinity with the first variety if it were not for the occurrence of intermediate forms. The

hydrothecæ are smooth, or nearly so, and the constriction below the aperture is absent or very slight on the outer side, while it is strongly marked on the inner, so that the terminal portion of the hydrotheca has the aspect of being recurved towards the hydrocaulus, an appearance which is strengthened by the outer marginal tooth being longer than the other two. The hydrothecæ in this variety are proportionately longer than in the others. Both series are strongly directed forwards, and when the pinnate form is fully developed the hydrophyton bears a remarkable similarity to that of *S. neglecta*, from which species it may be distinguished by the pinnæ being mostly alternate instead of sub-alternate, and being given off below each hydrotheca on the pinnate part of the stem instead of below every second one on each side, by the much shorter marginal teeth of the hydrotheca, and by the internal teeth, also by the different gonangia.

While it must be admitted that the arrangement of these varieties under one species is not perfectly satisfactory, they appear to run into each other by so many intermediate forms that I have so far failed to find any distinct line of demarcation between them. It is not improbable that *S. indivisa* will have to be referred to the same species, and perhaps *S. solidula*. All the varieties possess teeth within the hydrotheca-margin, one within each of the two upper sides, and either one or three within the lower side. The hydrotheca often has two minute rod-like thickenings of the perisarc about midway down, on opposite sides.

Sertularella solidula, Bale.

(Plate XV., figs. 3-4).

A specimen from Bondi, with the ends of the hydrothecæ curved outwards rather more than those of the type form.

Sertularella cylindrica, n.sp.

(Plate XVI., fig. 7).

Hydrocaulus about half an inch in height, simple or slightly branched, divided by oblique joints into internodes of moderate

length, each bearing a hydrotheca on its upper part. Hydrothecæ adnate nearly half their height, large, stout, cylindrical, smooth, usually somewhat rounded at the base, curved outwards ; aperture looking outwards and upwards, not contracted, margin entire, very slightly everted, peristome often double or triple.

Gonothecæ unknown.

Hab.—Port Jackson.

A single specimen occurred among a mass of *S. divaricata* var. *sub-dichotoma*. It is quite unlike any Australian species hitherto known, and may be readily distinguished by the uncontracted entire margins of the hydrothecæ. The latter somewhat resemble those of *Sertularia patula*, Busk, but are free for a much greater portion of their length. I could not satisfy myself of the existence of an operculum.

Synthecium, Allman.

The genus Synthecium differs from Sertularia in the gonosome, the pedicels of the gonangia having their origin within certain of the hydrothecæ, where they take the place of the hydranths. The *Sertularia orthogonia* of Busk, the gonosome of which has hitherto been unknown, belongs to this genus, so also doubtless does *S. patula*. The *Dynamena tubulosa*, Heller (Zoophyten und Echinodermen des Adriatischen Meeres), is evidently a Synthecium. Professor Allman has remarked that Heller's figure shows a gonangium springing directly from the stem, but I have no doubt that what Heller has figured is a parasitic hydroid like *Campanularia* (?) *costata*.

The five known species all agree in having opposite pinnæ, which spring from the stem at a point where there are no hydrothecæ, also in having the hydrothecæ opposite, tubular, curved outwards, and with the margin entire. Professor Allman's two species (which are probably reducible to one) have the hydrothecæ very much slenderer in proportion to the length than *S. orthogonia* and *S. patula* (which may perhaps be also united). Heller's species is likewise very similar to *S. patula*, and may be identical.

Synthecium orthogonia, Busk.

(*Sertularia orthogonia*, Busk, "Voyage of the Rattlesnake.")

(Plate XVII., figs. 1-5).

Hydrocaulus pinnate, attaining a height of about three inches; internodes of the stem long, each bearing a pair of pinnæ at the summit, and one or two pairs of hydrothecæ below (except the lower internodes, which commonly bear a pair of pinnæ only); pinnæ distant, opposite, widely divergent, divided into internodes, each with one pair of hydrothecæ. Hydrothecæ opposite, not in contact but often approximate in front, tubular, adnate most of their height, free part curved outwards more or less abruptly and often produced horizontally; aperture circular, vertical or directed slightly upwards, margin entire, very slightly everted, usually more or less marked with lines of growth.

Gonothecæ large, elongated, somewhat compressed in a plane vertical to that of the hydrocaulus, with about 8-10 distinct transverse undulations on the broader sides; aperture terminal, very small, without thickened border or distinct operculum.

Hab.—Off Ball's Head, Port Jackson.

I have no doubt that this is the *Sertularia orthogonia* of Busk, though the free part of the hydrothecæ is rarely produced outward to so great an extent as in the type form. This abbreviation of the hydrotheca tends to weaken the distinction between this species and *S. patula*, nevertheless it is still open to doubt whether they should be united. The hydrothecæ of *S. orthogonia* are longer than those of *S. patula*, and the adnate portion is decidedly more erect, while the free part is curved outwards much more abruptly, and the aperture is nearly or quite vertical, even when the terminal portion of the hydrotheca is somewhat ascending. The margin is not noticeably sinuated at the sides, and is marked with lines of growth even in the terminal hydrothecæ. In *S. patula* the hydrothecæ are smaller and are not abruptly flexed, but are gradually curved outwards for most of their length, while

at the same time the free portion is not nearly so divergent as is generally the case with *S. orthogonia*. The aperture is at right angles to the terminal part of the hydrotheca, and the margin is slightly sinuated at the two sides, while it is more everted than in *S. orthogonia*, and lines of growth seem rare. It is true that in each species calycles may be found which are somewhat intermediate, but there is no difficulty in distinguishing between such specimens as I have met with ; I therefore hesitate to unite them without further evidence.

The gonothecæ are large and compressed, so that in an ordinary view of the polypary they are seen edgewise, the transverse undulations then appearing very distinct. These undulations, however, do not run round the gonotheca, but are confined to the two broader sides, and gradually smoothed away towards the narrower sides, so that if the gonotheca be viewed in its broader aspect its outline appears smooth or nearly so. In Professor Allman's two species the undulations are continued till they meet two zig-zag median lines which run down opposite sides of the gonotheca ; the gonothecæ also are much shorter than those of *S. orthogonia*, and apparently not so compressed. One fragment of *S. orthogonia*, found among the rest, has gonothecæ not unlike those of Allman's species in size and shape, and showing chitinous ridges in the front view, which however do not run straight across to meet a mesial line, but form an entirely irregular network. I am not aware of the signification of these peculiar gonangia, so different from the ordinary ones, but they may be due to an accidental deformity.

The hydrothecæ of *S. orthogonia* are usually directed outwards, but in some specimens they are also turned towards the front, the opposite hydrothecæ being almost in contact in the front of the polypidom.

Sertularia geniculata, n. sp.

(Plate XVII., figs. 6-11).

Hydrocaulus simple, minute, with a pair of hydrothecæ on each internode, joints slender. Hydrothecæ opposite, in contact with

each other in front, separated behind, the outer side of each forming a strongly salient angle below the aperture; the body of the hydrotheca projecting forward from the internode, the distal portion twisted upwards; aperture nearly vertical, margin without distinct teeth.

Gonothecæ rather small, ovate, with 5 or 6 strong transverse costæ; one only on a shoot, springing from the basal part of the proximal internode.

This species, which I found running over the surface of a Flustra, is very small, none of the shoots which I observed bearing more than three pairs of hydrothecæ, the peculiar twisted form of which is very distinctive. The most nearly allied species is perhaps the *Dynamena conferta* of Kirchenpauer.

Sertularia complexa, S. F. Clarke.

(Plate XVIII., figs. 1-4).

Hydrorhiza stout, shoots simple, about half an inch in height, with a pair of hydrothecæ on each internode. Hydrothecæ opposite, in contact with each other in front, separated behind, long, tubular, free for about $\frac{1}{3}$ of their length, upper portion curved outward, the hydrotheca-wall produced downwards into two points below the inner side of the base; aperture vertical, margin with two lateral teeth or angular lobes.

Gonothecæ borne principally on the hydrorhiza, small, subglobular, truncate at the summit, with 6-8 distinct annulations; aperture operculate, margin not elevated, a few small irregular teeth within the margin.

Hab.—Bondi Bay: Yucatan, America (Clarke).

This slender species, which is found profusely over-running leaves of Zostera or Cymodocea, very nearly resembles *S. tuba* in the form of its hydrothecæ, but differs from that species in its simple habit and in the form of the gonothecæ. The two spines which in *S. complexa* project downwards from the base of the hydrotheca into the cavity of the hydrocaulus are also distinctive, but are

often wanting in some of the calycles. There is a conspicuous oblique joint at the base of the lowest internode of each shoot.

Mr. Clarke's figure and description* agree with our specimens, except that he represents the teeth of the hydrotheca-margin for the most part above and below the aperture rather than at the sides ; but one or two of his figures approximate to the present form in this respect, and the other details being precisely similar, I have little doubt that the identification is correct. The gonothecæ were not present in Mr. Clarke's specimens.

Sertularia elongata, Lamx.

Coogee.—A small specimen with some of the cauline internodes bearing only a pair of hydrothecæ and no pinnæ.

Pasythea quadridentata, Ellis and Solander.

(Plate XIV., figs. 6-7).

Coogee ; Bondi.

Of these specimens, that from Coogee most resembles the type, but is distinguished by the internodes being less elongated, so that the sets of hydrothecæ are close together. The Bondi specimens are peculiar, a considerable proportion of the internodes bearing only a single pair of calycles each ; indeed some of the shoots are so arranged throughout, and thus differ in no respect from a typical *Sertularia*. The apertures of the calycles are directed more to the front than in the type, and have blunter teeth, and the hydrothecæ generally, when not united in sets, strongly resemble those of some forms of *S. australis* and *S. loculosa* ; and as in the latter species the joints between the internodes are in some cases simple and inconspicuous, while in others the upper internode is produced downwards to a point, and the lower is similarly produced upward behind it.

I observed a single gonotheca, which was sub-globular, with about four not very prominent transverse annulations, and a large aperture with an elevated neck and an operculum.

*Report on the Hydroida collected during the exploration of the Gulf Stream and Gulf of Mexico, by Alexander Agassiz 1877-78. (Bull. Mus. Comp. Zool., Cambridge U.S., Vol. V No. 10)

Pasythea hexodon, Busk.

Plate XIV., figs. 8-9.

Hydrocaulus 1-2 inches in height, sub-dichotomously branched, with a hydrotheca in each axil; internodes tubular, long and slender, bearing the sets of hydrothecæ near their upper extremities, joints mostly inconspicuous. Hydrothecæ tubular, usually from six to ten in a set, often unequally arranged on the two sides of the internode, each one adnate to that next above it by a considerable part of its dorsal surface, and adnate to the hydrocaulus by its basal portion; the two series strongly divergent, the lower ones of a set more so than the upper, especially in their terminal portions; an angular ridge running down each side of the cell; aperture very oblique (sloped off from below), margin somewhat expanding at the upper part of each side, with two indistinct lateral lobes.

Hab.—Near Peel Island, Moreton Bay (Mr. J. D. Ogilby).

This species has not hitherto been recorded since Mr. Busk described it in the account of the "Voyage of the Rattlesnake." Mr. Busk says that there are six hydrothecæ in a set, but in these specimens there are commonly eight to ten, and sometimes more. While *P. quadridentata* is closely allied to the Sertulariæ, having its calycles in distinct pairs, with the two calycles of each pair in contact in front, *P. hexodon*, on the other hand, approximates to the Thuiariæ, the hydrothecæ being crowded and overlapping each other, as is so often the case in that genus, while there is no regularity in the arrangement of the two series with regard to each other. In most cases those on the two sides of the hydrocaulus are opposite to each other, but it is quite common to find them alternate, and the set frequently contains more on one side than the other, as three to four, or four to six. The ramification is not perfectly dichotomous, but branches are given off irregularly in the same plane, the axial hydrothecæ being adnate for most of their length to the principal shoot.

Thuiaria sinuosa, n.sp.

(Plate XVIII., figs. 9-10).

Hydrocaulus pinnate, stem indistinctly and irregularly jointed, fascicled below; pinnæ alternate, with few or no joints, three hydrothecæ between every two on the same side of the stem. Hydrothecæ opposite to alternate on the pinnæ, alternate on the stem, a rather wide space between the two series; long, subconical, each one curved first slightly outwards and then upwards, the extreme summit again curved outwards, adnate in their lower half to the hydrocaulus, and in their upper half to the next hydrotheca above, which they overlap; a conspicuous triangular area below the base of each; aperture small, semi-circular, looking directly outwards.

Gonothecæ borne in rows along the front of the pinnæ, obovate, with distinct transverse annulations, aperture large, margin elevated; a few long crooked teeth or spines inside the neck.

Hab.—Port Molle.

I received a small piece taken from a specimen in the Museum, which, Mr. Whitelegge informs me, is about two inches high, and incomplete. The species is allied in some respects to *T. fenestrata*, but the peculiar form and arrangement of the calycles distinguish it from all other known species. The stem has few joints and those indistinct; the shortest internode has two hydrothecæ on the same side as the pinna (which springs from between them and is in contact with both), and a single one on the opposite side. The longer internodes are equivalent to two or more of these with the joints obliterated. The shorter pinnæ in my specimen were without joints, the longer ones had a single joint not far from the end. There is a thinning away of the perisarc over the triangular spaces below the hydrothecæ, very much as in *T. fenestrata*.

Thuiaria quadridens, Bale.

A slender variety, from near Peel Island, Moreton Bay.

THUIARIA FENESTRATA, Bale.

Moreton Bay, Queensland; Port Phillip Heads, Victoria.

This species must be added to the list of those which occur on both the southern and north-eastern coasts, as I have received from Dr. MacGillivray a fine specimen obtained at Port Phillip Heads. The shoots are very numerous, and form a densely matted tuft; the two series of calycles are rather closer together than in other specimens which I have seen. Gonothecæ were present, and differ from the figure and description given in the "Catalogue," the border being plain. In representing the gonotheca as having four emarginations of the border, I followed a drawing of Mr. Busk's taken from a hydroid in the Gay herbarium, labelled *Salacia tetracyttara*, and identical with his *Sertularia crisioides* (*T. fenestrata*). The present specimens however, exhibit no trace of any toothed or emarginate state of the border.

PLUMULARIIDÆ.

ELEUTHEROPLEA.

AZYGOPLON, n.gen.

Hydrophyton pinnate, supracalycine sarcothecæ absent, mesial anterior sarcotheca not adnate to the hydrotheca, nor in contact with it.

Gonosome without phylactocarpal appendages.

This genus (of somewhat doubtful position) is proposed for the reception of the species which I originally described under the name of *Plumularia producta*, and is characterised mainly by the absence of supracalycine sarcothecæ, a feature which it exhibits in common with the genera Halicornopsis (*Azygoplon*, Allman) and Diplocheilus. The latter genus, however, is said to be distinguished by the presence of an external calycine envelope, and the former has the anterior sarcothecæ adnate to the front of the hydrothecæ, as in other Statoplea; while in Azygoplon the

anterior sarcothecæ are quite disconnected from the hydrothecæ, and bear a considerable resemblance to the corresponding organs in some of the Eleutheroplea. To that section, therefore, I would assign the new genus, more especially as the only Plumularian which is known to share with *A. productum* the peculiarity of possessing decumbent adnate gonothecæ (namely, *Plumularia filicaulis*) is an undoubted Eleutheroplean.

The generic name Azygoplon has already been applied by Professor Allman to another hydroid, for which, however, the name Halicornopsis had priority.

AZYGOPLON PRODUCTUM (= *Plumularia producta*, Bale).

(Plate XIX., figs. 1-5).

From an examination of specimens obtained by Mr. Whitelegge at Coogee, I am able to give a more complete account of this species than has hitherto been possible, the gonangia in particular, not having been previously observed. These are given off from the hydrorhiza, and are attached to the supporting substance by the flat under side, like those of *Plumularia filicaulis* and the whole hydrosoma of Lineolaria. The upper side is convex, and furnished with transverse undulations, which vary in distinctness, but do not appear to be ever very strongly marked; they are usually indistinguishable when seen from above in a fluid medium, but are readily seen by reflected light when dry. The gonothecæ are large in size, of an irregularly ovate outline, and there is at first no trace of an aperture, but after a certain time a rather large circular area of the capsule close to the distal end appears as if bulged in, forming a slight concavity bounded by a circular ridge at which separation ultimately takes place.

I have not alluded to the cauline sarcothecæ in former descriptions of this species, as I failed to see them satisfactorily in my first specimens, owing to their rudimentary condition and the wrinkling of the delicate perisarc; but I have been able to make them out in other cases, and particularly in Mr. Whitelegge's specimens. There are usually two at the base of each pinna, one

of which, situated in the axil, is larger than the other, and both are simply conical projections. In a specimen from Queenscliff the axillary sarcothecæ have a distinct incomplete partition just within the aperture, but this bithalamic condition is absent from the others. In several specimens I could only distinguish the axial sarcothecæ. Besides the sarcothecæ already mentioned there is sometimes one at the summit of each stem-internode in front.

The mesial anterior sarcothecæ consist, in their perfect form, of a lower chamber, or protuberance of the pinna, terminating in a shallow concave or saucer-shaped receptacle facing the hydrotheca, and emarginate below, where the rim terminates at each side by becoming united to the pinna. In Mr. Whitelegge's specimens however, the wall of the upper loculus is usually cut away on both sides so that there remains only a scoop-shaped projection directed towards the hydrotheca from the top of the lower chamber, and presenting, when seen in front view, a more or less rectangular form. Some of the sarcothecæ however approximate to the ordinary form, while different varieties of the species present various intermediate forms between the extremes above-mentioned.

There is a striking resemblance between this species and the *Diplocheilus mirabilis* of Professor Allman's "Challenger" Report, so far as the more important structural features are concerned. Both species agree in the absence of the supracalycine nematophores, and in having the anterior nematophore unattached to the calycle, and even the peculiar form of the nematophores appears almost alike in both species, except that those of *A. productum* are more erect. The only distinction of more than specific value is the presence in *D. mirabilis* of an external envelope surrounding the upper part of the hydrotheca, and from analogy with several other species it seems extremely probable that the external envelope is really the outer surface of a *thickening* of the calycle, and not a distinct structure. Such thickenings of the perisarc are by no means rare, familiar examples being the stem-internodes of *Obelia geniculata* and the calycle-wall of *Campanularia caliculata*, while in Eucopella we have an extreme case, the hydrotheca being almost entirely filled by a

solid mass of chitinous substance. Sometimes this substance is marked by striæ indicating variations of density, and proving its solidity; but in some cases, as in *C. caliculata*, it is homogeneous, so that the hydrotheca resembles an inner cup with an outer calycine envelope, the illusion being, as Mr. Hincks says, so complete that he at first described this as the actual structure. The hydrothecæ of *Plumularia delicatula* are considerably thickened internally at the same part where in *D. mirabilis* the calycine envelope is said to exist, and specimens of *P. setaceoides* in the present collection have an external thickening in front still more extensive. *A. productum* itself is frequently thickened in the same fashion, if not to the same extent. That this should be the case with some specimens and not with others is quite conformable to experience; for example, in some forms of *C. caliculata* there is no noticeable thickening of the calycle, and Dr. von Lendenfeld finds a similar variation in Eucopella. When the chitinous mass is homogeneous in appearance it appears to be very incompletely solidified, so that drying it, or immersing it in a dense medium, such as Canada balsam, causes it immediately to shrink.

While it would be impossible to decide absolutely, without examination, that the structure of *D. mirabilis* is as I have suggested, the analogy of the other species mentioned is so strong as to render such a conclusion highly probable, in which case *D. mirabilis* and *A. productum* would be clearly referable to the same genus. As regards specific characters, *A. productum* differs from *D. mirabilis* in its much smaller size, in the form of the hydrotheca, in the presence of a distinct anterior intrathecal ridge, and in some minor features.

Plumularia campanula, Busk.

(= *P. laxa*, Allman; *P. Torresia*, von Lendenfeld).

(Plate XX., figs. 1-6).

The specimens from the Museum, as well as some from Port Phillip Heads, sent me by Mr. J. B. Wilson, include the gonothecæ, which I have hitherto been able to describe very imperfectly,

owing to my former specimens having been all dried, and more or less shrivelled. The female capsules are nearly three times the length of the hydrothecæ, pear-shaped, slightly flattened above, and tapering off gradually below, and are provided with a pair of sarcothecæ near the base, one on each side. When ripe they open at the summit by a circular operculum, the border of the orifice being very slightly thickened. Between the short pedicle and the capsule itself there is a distinct sub-globular segment. In some specimens the capsules are broader towards the summit than in others. The male gonothecæ are considerably smaller, ovate, not flattened at the summit, and have only a single sarcotheca. Male and female gonothecæ are borne on the same colony.

Many of the pinnæ of *P. campanula* bear secondary hydrocladia, but the character is not constant. A single pinna may bear two or three of these offshoots arranged alternately, and occasionally tertiary hydrocladia are produced.

The hydrothecal internodes vary considerably in length in different specimens, or even in the same colony, the hydrothecæ varying accordingly in their distance apart, so that the superior median sarcotheca, which is normally placed some distance above the hydrotheca, may be situated almost behind the free margin.

P. campanula differs from all other species known to me (except *P. rubra*) in the short stout lateral sarcothecæ, which, moreover, are not freely moveable.

The type specimens prove that *P. Torresia* is identical with *P. campanula*. Dr. von Lendenfeld represents the calycle-margin as somewhat incurved, and with a double tooth at the back, but as there is no trace of these peculiarities in his types, they are probably due to distortion in mounting.

Dr. von Lendenfeld's specimens, from Torres Straits, agree precisely with those collected by Mr. Wilson at Port Phillip Heads; others from Broughton Islands have the female gonotheca somewhat narrower.

Plumularia rubra, von Lendenfeld.

(Plate XX., figs. 1-6).

Hydrocaulus about three inches high, stems clustered, monosiphonic, unbranched, bearing hydrothecæ as well as pinnæ. Pinnæ alternate, distant, one on each internode, often supporting secondary hydrocladia, joints oblique, a hydrotheca on each internode, except the first on each pinna. Hydrothecæ borne at the lower ends of the internodes, set at an angle of about 40°, large, campanulate, margin entire, free at the back. Sarcothecæ bithalamic, canaliculate, fixed and stout at the base; one at each side of the hydrotheca, pedunculate, one in front, one (or on the stem two) midway between every two hydrothecæ, on the same internode as the lower, and one on the proximal internode of each pinna.

Gonothecæ—female, large, pear-shaped, somewhat flattened above, tapering below, with a distinct sub-globular segment at the base of the capsule, and a sarcotheca at each side a little above the base; a circular operculum at the summit, the border of the aperture slightly thickened:—male, small, with one sarcotheca only; both sexes on the same shoot.

Hab.—Port Jackson.

The minute structure of this species is identical in every particular with that of *P. campanula*, both as regards the trophosome and the gonosome; but in *P. campanula* the pinnate branches are borne by a polysiphonic stem, while in *P. rubra* the pinnate shoots spring directly from the hydrorhiza. A stem of *P. rubra* therefore corresponds to a branch of *P. campanula*, except that it is usually larger.

Plumularia setacea, Ellis.

P. tripartita, von Lendenfeld.

(Plate XX., figs. 14-18).

Hydrocaulus about 1½ inches in height, monosiphonic, sometimes branched, pinnæ alternate, not close, one borne near the

summit of each internode, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ small, cup-shaped, much expanded upwards, adnate up to the margin, aperture nearly at right angles with the pinna. Sarcothecæ bithalamic, canaliculate, slender at the base and moveable; one below each hydrotheca and one at each side above it, one between every two hydrothecæ, on the intermediate internode, one at the base of each pinna, and one on the lower part of each stem-internode.

Gonothecæ borne in the axils, rather slender, fusiform, with a tubular neck directed to one side.

Hab.—Timaru, N.Z. (Dr. von Lendenfeld); Port Phillip Heads (Mr. J. B. Wilson).

The specimens of *P. tripartita* (which are among Dr. von Lendenfeld's types) do not possess any features by which they might be distinguished from *P. setacea*, the tripartite form of the hydranth being only an occasional feature. The hydrophyton is normally unbranched, but some of the shoots bear several lateral branches, which are very peculiar in their origin, since they commence as ordinary pinnæ or hydrocladia, and only become modified into branches beyond the first internode, which bears a hydrotheca and nematophores in the usual way. Mr. Hincks mentions a branched variety of *P. setacea* as occurring in Britain, but does not state whether the branches are modified from hydrocladia as in the present case.

Plumularia Wattsii has hydrocladia with the hydrothecæ and sarcothecæ similar in form and arrangement to those of the present species, but the pinnate shoots, instead of springing directly from the hydrorhiza, are borne on a long slender jointed stem.

PLUMULARIA TURGIDA, n.sp.

(Plate XX., figs. 12-13).

Hydrocaulus 1½-2 inches in height, monosiphonic, sometimes branched; pinnæ alternate, not close, one borne near the summit of each internode, divided into alternate long and short internodes,

of which only the former bear hydrothecæ. Hydrothecæ cup-shaped, slightly expanded upwards, adnate up to the margin, aperture at right angles with the pinna. Sarcothecæ bithalamic, canaliculate, slender at the base and moveable, one below each hydrotheca and one on each side above it, one between every two hydrothecæ, on the intermediate internode, two at the base of each pinna (one in front of the axil and one behind), and one on the lower part of each stem-internode.

Gonosome unknown.

Hab.—Lyttleton, N.Z. (von Lendenfeld).

This species is very closely allied to *P. setacea* in most respects, including the peculiar mode of branching, but is a little paler in colour, with the pinnæ more lax and less divergent. The hydrothecæ are proportionately broader at the base and less expanding upwards, while the pinna is more abruptly swollen below the hydrothecæ, giving the species a somewhat distinctive aspect. Another characteristic of *P. turgida* is the presence of a sarcotheca behind each axil as well as in front. An American Hydroid identified by Clarke* with *Plumularia setacea* resembles the present species in these particulars, but is very much larger in growth, measuring sometimes as much as 300 mm.

Plumularia caliculata, n.sp.

(Plate XX., figs. 9-10).

Hydrocaulus monosiphonic, about ½ inch high, pinnæ alternate, not close, one borne near the summit of each internode, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ cup-shaped, shallow, slightly expanding upwards, adnate up to the margin, aperture nearly at right angles with the pinna. Sarcothecæ bithalamic, canaliculate,

*Hydroids of the Pacific Coast of the United States, south of Vancouver Island, &c., S. F. Clarke.—Trans. of the Connecticut Academy of Arts and Sciences, Vol. III., Part 2.

slender at the base and moveable; one below each hydrotheca, and one at each side above it, one between every two hydrothecæ, on the intermediate internode, one at the base of each pinna, and one on the lower part of each stem-internode.

Gonothecæ small, ovate or oblong, somewhat compressed, slightly narrowed at the summit.

Hab.—Bondi Bay, Port Jackson.

This species differs from *P. setacea* in its smaller size, and in the gonothecæ, which are stouter in proportion, and have no neck. As seen in side view they are nearly oblong, but in front view they are somewhat barrel-shaped. Some of them are rather abruptly narrowed towards the summit, but this is not always the case; possibly the difference is developmental. The hydrothecæ are somewhat shallower in proportion to their height than those of *P. setacea*, and more rounded. In one of the specimens the pinnæ are borne in opposite pairs at the summit of each internode, except at the upper part, where the ordinary alternate arrangement recurs.

Plumularia setaceoides, Bale.

Bondi. (Plate XX., figs. 7-8).

This is a rather small form of *P. setaceoides* with short pinnæ, and, like the small southern variety, has the hydrothecæ shallower and more expanding towards the aperture than the long slender form. They are also set at a wider angle on the pinna, and have the front so much thickened as to present the appearance of an outer chitinous investment at this part. The thickened portion shrinks when the zoophyte is preserved in balsam, and even to some extent when in water. Gonangia are plentiful in these specimens, and agree in their general form with those of the type. The large sporosac is sometimes surrounded at the summit by a circle of highly refractive granules, which, as they are not present in all the gonothecæ, would appear to belong only to a particular stage of growth.

In the absence of the gonosome, the present species may be at once distinguished from *P. setacea* by the calycles being free for part of their length.

Plumularia alata, n.sp.

(Plate XIX., figs. 6-10).

Hydrorhiza with transverse markings along the margin; hydrocaulus minute, monosiphonic, unbranched, internodes at lower part of stem fusiform, those above more slender, cylindrical; pinnæ alternate, one on each internode of the stem, divided into alternate long and short internodes, of which only the former bear hydrothecæ. Hydrothecæ tubular, slightly curved outwards, the base springing from a protuberance of the pinna; aperture partly terminal, emarginate behind, and partly continued as a narrow sinus nearly half way down the front of the hydrotheca; the sides of the margin forming two lobes, which are somewhat recurved towards the pinna. Intrathecal ridge anterior, projecting from the front extremity of the aperture into the cell in a backward and upward direction; an external narrow projecting web partly crossing the hydrotheca and pinna on each side immediately behind the lateral sarcotheca. Hydrothecal internodes with three transverse folds or constrictions. Sarcothecæ bithalamic, canaliculate, slender at the base and moveable; one immediately below each hydrotheca and two laterals behind it, one between every two hydrothecæ, on the intermediate internode, two on each stem-internode, and a number scattered over the hydrorhiza.

Gonosome unknown.

Hab.– (?)

This is a noteworthy species for several reasons, not the least of which is its small size. Out of all the specimens examined the largest were only $\frac{1}{8}$ inch in height, or less than any other known Plumularian. The form of the hydrotheca, more especially of the aperture, is unlike that of any other species, the aspect presented in a front view being that of a narrow longitudinal opening half

the length of the hydrotheca, terminating below in a slight rounded enlargement, and above in a similar but larger extension at the end of the hydrotheca. The supracalycine sarcothecæ are set behind the upper part of the hydrotheca, so that in a front view they can only be seen by focussing down through it. The possession by this species of a distinct intrathecal ridge, anterior in position, is a feature which, though common among the Australian Statoplea, has not hitherto been recorded as occurring in any member of the Eleutheroplean group, except in a single doubtful species, *Azygoplon productum*; the true Plumulariæ which are furnished with an intrathecal ridge, as *P. spinulosa*, *P. filicaulis*, &c., having it in a posterior position. The lateral external webs, which appear to partly shelter the lateral sarcothecæ, are so delicate that they escape observation except on a careful scrutiny. Somewhat similar structures occur in *P. filicaulis*.

P. alata was found growing on a red frondose alga, which was given to me by Dr. Ralph, who was uncertain whether it had been collected in New Zealand or Victoria.

Plumularia spinulosa, Bale.

(Plate XIX., figs. 11-13).

Coogee Bay (Mr. Whitelegge).

The gonosome of this species has been hitherto unknown, but Mr. Whitelegge's specimens contain some gonothecæ, which are very large, ovate, truncate above, and with the margin rather widely everted. They somewhat resemble those of *P. obliqua*, a species which agrees with the present in many respects, especially in the form and arrangement of the sarcothecæ. *P. spinulosa* however may be distinguished by the more compressed hydrothecæ, the large intrathecal ridge, the abrupt narrowing of the pinna behind the calycle, and by the pinna being pointed at the end. The specimens from Coogee differ from those I had previously seen in having the pinna shorter, terminating in a blunt conical

point, which only rises about as high as the rim of the hydrotheca, instead of being produced into a longer spine. The hydrothecæ also are proportionately longer from back to front.

Bondi Bay. PLUMULARIA PULCHELLA, Bale.

A few fragments of this species occurred along with specimens of *Pasythea quadridentata*, from the above locality.

PLUMULARIA COMPRESSA, Bale.

Botany. (Plate XIX., fig. 14).

Except that the base of the hydrotheca is sometimes a little less angular, these specimens agree with the type in all but size, being only about $\frac{1}{6}$ of an inch high, with all the parts small in proportion. The gonosome was wanting.

PLUMULARIA AURITA, n.sp.

(Plate XIX., figs. 15-19).

Hydrocaulus monosiphonic, unbranched, about $\frac{1}{4}$ inch in height; stem slender, pinnæ alternate, each borne near the summit of an internode, and supporting a single hydrotheca; distal part curved from under the base of the hydrotheca, smooth, swollen at the summit on the inner side. Hydrothecæ rounded at the base, slightly compressed laterally, aperture at right angles to the cell and pinna, margin sinuated behind down to the summit of the pinna, no intrathecal ridge. Sarcothecæ monothalamic, or with a rudimentary division, canaliculate, stout at the bases, one below each hydrotheca, fixed, its oblique aperture almost appressed to the front of the cell, one at each side above the hydrotheca, very large, open on one side nearly down to the base, one in each axil, simple, bract-like.

Gonothecæ from 3 to 4 times the length of the hydrotheca, very convex behind, nearly straight in front, aperture looking outwards

and partly downwards, margin not everted, an incomplete partition extending some distance into the neck, from just below the orifice.

Hab.—Botany.

This species is very closely allied to *P. compressa*, but may be distinguished by the more slender hydrosoma, the rounder basal part of the hydrotheca, the large supracalycine sarcothecæ, the absence of the intrathecal ridge, and by the margin of the hydrotheca being less elevated above the top of the pinna, as well as by the distinct gonothecæ.

STATOPLEA.

I have elsewhere* given reasons for modifying Professor Allman's definitions of the genera Aglaophenia and Lytocarpus, and need only mention here that the former genus is taken to comprise all those species which combine the typical trophosome of the Statoplea with a gonosome distinguished by the presence of a *corbula*, open or closed, and variously modified, but always composed of a number of ribs or leaflets (nematocladia) which spring from a modified pinna; while Lytocarpus consists of species which have a similar trophosome, but in which the gonangia are borne on separate nematocladia, each of which is formed by the modification of a distinct pinna.

It is generally considered, in accordance with the views of Professor Allman, that the rachis of the Aglaophenian corbula is a modified hydrocladium, and the ribs the modified mesial nematophores of the hydrothecæ which are sometimes present, but in other cases are suppressed. It was formerly supposed that the corbula was formed from a branch, and that the ribs were modified pinnæ, but to this view it was objected that the corbula took the place of a pinna, and that the frequent presence of one or more hydrothecæ on the basal part of the rachis negatived the idea of its being a branch. From the descriptions of *P. setacea* and *P.*

*"The Genera of the Plumulariidæ," &c. Trans. Royal Soc. of Victoria, Vol. XXIII. (1887), page 83.

turgida in the present paper, however, it will be seen that ramules which commence as true hydrocladia like the rest may become transformed beyond the first internode into true branches, with exactly the same structure as the stem. It is therefore an open question whether the same thing does not happen in Aglaophenia, the rachis of the corbula forming a true branch, and the ribs being modified hydrocladia. It may be noted that two of the species of Aglaophenia described in this paper have the gonangial ramulus provided with a series of sarcothecæ only below the corbula, like the proximal portions of the ordinary branches in some species.

Lytocarpus Phillipinus, Kirch.

(= *Aglaophenia urens*, Bale (not Kirchenpauer).

(Plate XXI., figs. 5-7).

Hydrocaulus polysiphonic, branched, 7-8 inches in height, the primary branches all directed to one side, curved outward; branchlets forming rather a small angle with the main branches; pinnæ close, alternate, one on each internode, both series springing from the front of the stem or branch. Hydrothecæ parallel with the pinna in their longer diameter; basal part constricted on the side next the pinna; deeply constricted between the aperture and the mesial sarcotheca, and abruptly recurved, so that the aperture is nearly vertical; aperture wide, the sides elevated, each forming an angular lobe (sometimes rounded); front entire or with a small tooth, back straight or slightly sinuated, free. Hydrothecal internodes with two slight divergent folds or constrictions—one nearly opposite the basal constriction of the hydrotheca, the other at the base of the lateral sarcothecæ. Mesial sarcotheca nearly double the height of the hydrotheca, adnate to it nearly as far as the constriction on the upper side, and mainly rising from it; free part projecting forward, tapering, with distinct terminal and lateral apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ tubular, divergent, adnate to the hydrotheca as far as the margin and rising above it, inclined at about the same angle as

the mesial sarcotheca, but with the free part usually directed more forward; terminal and lateral apertures distinct. Cauline sarcothecæ conical, with terminal and lateral apertures sometimes united—two on the stem at the base of each pinna, and one on the pinna itself.

Gonangial pinnæ supporting a hydrotheca on the first internode, and on each of the next two (or sometimes on one only) a gonotheca, which springs from a prominence consisting of a modified hydrotheca with mesial and lateral sarcothecæ; the rest of the pinna forming a nematocladium of several internodes, bearing sarcothecæ mostly arranged in sets of three (one mesial and two lateral). Gonothecæ ovate or rounded, much flattened, and provided with a marginal wing, the sporosac surrounded by a circle of highly refractive granules.

Colour, light brown.

Hab.—Moreton Bay, Queensland, very common, obtained in the dredge (Mr. John Brazier): Manila (Kirchenpauer).

The specimens which I received from Mr. Brazier included the gonosome, which, as well as the trophosome, agrees very well with Kirchenpauer's figures and description. The ramification of this species is peculiar, the straight or slightly curved stem giving origin to a number of branches which are almost always directed to one side: examined closely, however, they are usually found to form two series, being directed alternately a little to the right and left. Normally, each side of the hydrotheca forms an angular lobe, but these lobes are often rounded off so that the sides are only slightly elevated.

Among the first hydroids sent to me from the Australian Museum were two specimens which I referred in the "Catalogue," but with much doubt, to the *Aglaophenia urens* of Kirchenpauer. According to Kirchenpauer the hydrotheca-margin of *A. urens* is entire, while in the specimens referred to it forms angular or rounded lobes at the sides, a difference, however, which did not appear of great importance. But the branches of *A. urens* are

represented as widely divergent, which was not the case with the Museum specimens, and I have observed that the angle at which branches spring from the stem usually varies but little within the limits of a species. These specimens now appear to me identical with *A. phillipina*, the hydrothecæ and sarcothecæ being exactly similar to those of Mr. Brazier's specimens, and the hydrothecæ varying in the same directions, the branching, as nearly as I could judge from the specimens, (which were fragmentary) being also similar. The only difference which I can find is in the colour, which is somewhat darker, but this is partly due, both in the original specimens, and in another of the same type in the present collection, to a number of minute black specks scattered irregularly over the interior of the polypary, and which are probably not constant. On the whole, though the gonosome is absent, I have little doubt that the specimens which I formerly described as *A. urens* belong really to *A. Phillipina*.

In Kirchenpauer's description no mention is made of the fact that the gonothecæ spring from modified hydrothecæ, but his figure shows this as the structure. He describes the sarcothecæ above the gonothecæ as being in pairs decussately arranged, but though they may present such an appearance in certain aspects, most of them are really in threes, representing the mesials and laterals of the suppressed hydrothecæ. The first one or two above the gonotheca, however, are borne at the side of the nematocladia without any to correspond on the opposite side. The gonothecæ are supported on very long internodes, and the contents of the proximal one ripen first; in fact, I found in most cases only one on the nematocladium, the first having ripened and fallen off. Sometimes, however, only one is produced. The young gonothecæ are nearly circular in outline, with a broad marginal wing, but those which are fully developed are ovate, with the gonotheca larger and the wing narrower. The ring of granules surrounding the sporosac is similar to those of *Halicornaria (Lytocarpus) saccaria*, which has been described by Professor Allman (Journal of the Linnean Society, Zoology, Vol. XII.).

The thread-cells (which I found in all the specimens) are slender-lanceolate bodies, often slightly curved and reaching an unusual size (about 3-1000 of an inch). The sheath, or axial body, is a very hyaline structure, with markings resembling a loosely-coiled double spiral; the dart is an exceedingly fine simple filament 1-100 of an inch, or even more, in length. They are found in profusion, not only in the sarcothecæ, but within the cavity of the hydrocaulus, where it seems impossible that they should be of any value as weapons of offence or defence.

Besides the two sarcothecæ on the stem at the base of each pinna, there is one on the basal part of the pinna itself, a feature which I have not observed in any other species.

The ultimate branches (which are often monosiphonic throughout or in part) have a long oblique joint near the base, between which joint and the origin of the branch there is a series of median sarcothecæ, but no pinnæ.

Lytocarpus urens, Kirch., sp.

(*Aglaophenia urens*, K.)

While the specimens which I described and figured in the "Catalogue" under the name of *Aglaophenia urens*, K., appear to belong to *Aglaophenia (Lytocarpus) Phillipina*, K., it is probable that the description there given will apply in most particulars to the true *A. urens*. Kirchenpauer, however, represents the hydrotheca of that species with the margin entire, or, in Australian specimens, with a small anterior tooth, but without angular lobes at the sides. I am not aware whether *L. urens* has a sarcotheca on the basal part of each pinna, like *L. Phillipinus*.

According to Kirchenpauer's figure and description there is a polysiphonic stem 7-8 inches high, with branches which are mostly divergent almost at right angles, and some of which are rebranched. The stem is blackish, the branches lighter, and the pinnæ are very short. The hydrothecæ and sarcothecæ are of the same general type as those of *L. Phillipinus*, except in the absence of the angular

lobes at the sides of the former. Each gonangial pinna bears a single gonotheca with a pair of sarcothecæ, and the distal portion is reduced to a blunt spine. The proximal internode bears appendages, but the figure is not sufficiently detailed to indicate whether they are hydrothecæ or sarcothecæ. The gonothecæ are described as unusually small, but visible to the naked eye as black points. The ring of bright granules, which in the allied species surrounds the sporosac, is not shown in Kirchenpauer's figure of this species.

L. urens possesses powerful urticating properties, being described as stinging like a nettle.

Aglaophenia parvula, Bale.

Hab.—Port Jackson.

In these specimens the second tooth on each side of the hydrotheca is almost completely merged with the third, a condition also common in Victorian specimens.

Aglaophenia sinuosa, n.sp.

(Plate XXI., figs. 1-2).

Hydrocaulus monosiphonic, slightly branched, 1-2 inches high; pinnæ long, approximate, alternate, one on each internode. Hydrothecæ set at an angle of about 40°, tapering to the base, with two well-developed intrathecal ridges, one close to the base of the calycle, on the side next the pinna, the other near the middle on the opposite side; the hydrotheca constricted at each of the ridges; aperture nearly horizontal, margin with a median tooth in front and four teeth on each side, the last pair opposite the lateral sarcothecæ, (one pair sometimes obsolete), back adnate; a median ridge or keel running along the front of the hydrotheca from the anterior intrathecal ridge and terminating in a point over the median marginal tooth. Hydrothecal internodes *sometimes* provided with 1-3 transverse folds. Mesial sarcotheca about half the length of the hydrotheca, or rather less, prominent, canaliculate. Lateral

sarcothecæ canaliculate, abruptly curved outwards, projecting forwards about as far as the margin of the hydrotheca. Cauline sarcothecæ broad, canaliculate, two on the front of the stem at the base of each pinna, and a large one, usually bifid, behind each axil.

Gonangial pinna bearing a single hydrotheca below the corbula. Corbula consisting of about 10 pairs of alternate ribs, each springing from a separate internode of the rachis, expanded into rather narrow leaflets, which are united to each other so as to form a closed corbula: the lines of union of the leaflets indicated by narrow thickened ridges (without sarcothecæ), a median ridge running up each leaflet bearing a series of canaliculate sarcothecæ; the median ridge often united to the next junction-ridge behind by a few irregular short thickenings; a bifid sarcotheca on the basal part of each leaflet, situated between the median ridge and the distal margin; one (or two?) sarcothecæ on the rachis at the base of each leaflet.

Colour, brown.

Hab.—Port Denison.

The largest specimen I received was about 1½ inches long, with a single branch near the foot. The species may be readily distinguished by the structure of the hydrothecæ, which are peculiar in having both the anterior and posterior intrathecal ridges fully developed, and forming two partitions, each projecting half-way through the hydrotheca, but in opposite directions. The keel which extends along the front of the hydrotheca is also an unusual feature. The corbula is completely closed, and the leaflets which compose it are narrower than is usual in closed corbulæ, so that the rows of sarcothecæ are closer together, while their position is along the middle of each leaflet, not as is generally the case at the margin.

Aglaophenia macrocarpa, n.sp.

(Plate XXI., figs. 3-4).

Hydrocaulus polysiphonic, with divergent branches, stem and main branches thick and woody, pinnæ approximate, alternate,

one on each internode, both series borne towards the front. Hydrothecæ rather long, set at an angle of about 40°, nearly cylindrical in the distal half, and tapering downwards to the base; a fold or rudimentary intrathecal ridge near the base on the side next the pinna; aperture with a sharp pointed median tooth in front, and on each side a short tooth and a broad rounded lobe, the latter uniting with the lateral sarcothecæ, back slightly sinuated, adnate. Hydrothecal internode with two transverse folds, one opposite the base of the lateral sarcothecæ, the other opposite the rudimentary intrathecal ridge. Mesial sarcotheca about $\frac{2}{3}$ as long as the hydrotheca, adnate, only slightly projecting, canaliculate. Lateral sarcothecæ canaliculate, directed forward and strongly outward, projecting a little beyond the hydrotheca-margin. Cauline sarcothecæ conical, canaliculate, two on the stem at the base of each pinna.

Gonangial pinna with two or three short distinct joints at the base, bearing only sarcothecæ. Corbula very long, consisting of nearly 20 pairs of alternate ribs, springing from separate internodes of the rachis as narrow pinnules, but expanding above into broad leaflets, which are attached to each other along the margins, the lines of union being provided with a series of small canaliculate sarcothecæ : a short lateral spur projecting outwards and forwards from the distal side of each rib just above the base, bearing several sarcothecæ larger than the rest, but no hydrothecæ. One or more of the proximal ribs free, not expanded. A small sarcotheca on the rachis below the origin of each rib.

Colour, dark brown.

Hab.—Off Port Jackson.

The specimens were incomplete, the principal one consisting of a fragment of the fascicled stem with two branches about an inch apart on the same side set almost at right angles with the stem, the longer one being complete, and about three inches long. The piece of stem was about $\frac{1}{16}$ inch in diameter, and retained the pinnæ almost throughout. The form of the hydrotheca-margin is different from that of any other species known to me, and the

species may be readily distinguished by it. The corbula (which sometimes exceeds one-fourth of an inch in length) is closed above, but the sudden narrowing of its component leaflets towards the base leaves openings, across which project the lateral spines, corresponding to the processes which in some species bear hydrothecæ, but which here support only 2-4 sarcothecæ.

Aglaophenia phyllocarpa, n.sp.

(Plate XXI., figs. 9-10).

Hydrocaulus polysiphonic, pinnæ alternate, one on each internode, both series springing from the front. Hydrothecæ lying parallel with the pinna, very large, elongate, sub-cylindrical; a slight fold or rudimentary intrathecal ridge near the base on the side next the pinna; aperture oblique, with eleven nearly equal claw-like incurved teeth, one median, and five on each side, back deeply sinuated next to each of the lateral sarcothecæ, and with a broad rounded lobe between, adnate to the pinna. Hydrothecal internode narrow, with 3 transverse folds, one opposite the fold in the hydrotheca, one at the base of the lateral sarcothecæ, and one midway between. Mesial sarcotheca very short, projecting outwards from the pinna and the basal part of the hydrotheca, free part conical, canaliculate. Lateral sarcothecæ canaliculate, projecting outwards and extending beyond the hydrotheca-margin, free part conical, directed forwards, slightly upwards, or downwards, sometimes abruptly recurved so as to point towards the back of the pinna, and away from the hydrotheca at a right angle. Cauline sarcothecæ on the front of the stem, two at the base of each pinna, the lower larger.

Gonangial pinna with 3 or 4 short distinct joints at the base, bearing only sarcothecæ. Corbula large, consisting of about 10 pairs of alternate ribs, expanded into very large leaflets, each of which is attached by its proximal margin to about the middle of the next leaflet behind; the distal half of each leaflet forming a large free expansion bordered with canaliculate sarcothecæ; each

main leaflet giving origin at the base to a smaller secondary free leaflet, which is directed forwards and downwards, and has the anterior margin fringed with sarcothecæ.

Colour, brown.

Hab.—Port Denison.

This species, in the form and position of the calycles and the relative shortness of the mesial sarcothecæ, is wholly unlike any other Australian species yet known. I have received only a single incomplete specimen about $\frac{3}{4}$ of an inch long. The pinnæ are long and the stem is slender, composed of two or three tubes only. The corbula is very remarkable, as half of each leaflet is devoted to the formation of the proper corbula-wall, while the other half is a broad free wing. The secondary leaflets take the place of the process which in some species bears a hydrotheca, but are peculiar from their comparatively large size. The two series of these appendages are directed backwards from the corbula, so that the rachis is between them. Only one corbula was present.

[Aglaophenia (?) Whiteleggei, n.sp.

(Plate XXI., fig. 8).

Hydrocaulus polysiphonic, with ascending branches; pinnæ long, alternate, one on each internode, both series springing from the front. Hydrothecæ having their proximal portion nearly parallel with the pinnæ, distal portion curved outwards so that the aperture is nearly vertical, a fold or rudimentary intrathecal ridge a little above the base, on the side next the pinna, aperture with a long slightly incurved tooth in front, and two triangular or slightly rounded lobes at each side, back entire, free. Hydrothecal internodes with two folds, one opposite the fold of the hydrotheca, the other at the base of the lateral sarcothecæ. Mesial sarcotheca tubular, a little longer than the hydrotheca, free part projecting, somewhat swollen in the middle, with distinct terminal and lateral apertures, and an orifice opening into the hydrotheca. Lateral sarcothecæ tubular, divergent, adnate to the hydrotheca as far as

the margin, and projecting beyond it, less inclined forward than the mesial, except the distal portions, which are bent forward; terminal and lateral apertures distinct. Cauline sarcothecæ usually canaliculate, two on the stem at the base of each pinna.

Gonosome unknown.

Colour, stems and branches light brown, pinnæ whitish.

Hab.—?.

In the absence of the gonosome the generic position of this species is doubtful, a similar type of hydrotheca being found in species of Aglaophenia, Lytocarpus, and Halicornaria. It differs from most allied species in having each side of the hydrotheca-margin cut into two nearly equal angular lobes instead of one large one. The distal part of the hydrotheca is bent away from the pinna, but not sharply recurved, as in *L. Phillipinus* or *A. longicornis*, so that there is no sharp deep constriction of the front of the hydrotheca as in those species, nor anterior intrathecal ridge, as in *A. plumosa*.

The only specimen I received is about two inches high, but is incomplete; there are three or four branches, and the pinnæ extend along the greater part of the stem. The pinnæ and hydrothecæ are colourless, and when filled with remains of the soft parts appear white; they are very fragile and apt to shrivel when dried or placed in balsam. Possibly, however, other specimens may be more robust.

EXPLANATION OF PLATES XII.-XXI.

The figures have been drawn with the assistance of the camera lucida, from specimens viewed as transparent objects.

Plate XII.

Fig. 1-2.—*Obelia australis*, v. Lend. Lyttleton, N.Z. (from Dr. von Lendenfeld's type specimen).

Fig. 3.—*Obelia angulosa*, n.sp. Parramatta River.

Fig. 4.—*Campanularia (?) serrulata*, n.sp. Port Jackson.

Fig. 5.— ,, *(?) bispinosa*, n.sp. Port Jackson.

Fig. 6.— ,, ,, a portion of the calycle-margin, seen from outside.

Fig. 7.—*Campanularia bispinosa*, one of the marginal teeth, lateral view.

(All except 6 and 7 magnified 40 diameters).

Plate XIII.

Fig. 1-3.—*Campanularia caliculata*, Hincks. Port Jackson. (All from one colony).

Fig. 4-7.—*Campanularia caliculata* var. *makrogona*, v. Lend. Port Jackson. Different hydrothecæ from the same colony.

Fig. 8.—*Campanularia caliculata* var. *makrogona*, outline of gonotheca.

Fig. 9-10.—*Eucopella campanularia*, v. Lend. Bondi.

Fig. 11— ,, ,, irregular calycle, from the same polypary.

Fig. 12-14.—*Eucopella campanularia*, from another variety.

Fig. 15.— ,, ,, gonotheca, same specimen.

Fig. 16.—*Laföea scandens*, n.sp., on *Sertularella divaricata*. Port Jackson.

Fig. 17.— ,, ,, base of hydrotheca, from behind.

Fig. 18.— ,, ,, gonotheca, with contents.

Fig. 19.— ,, ,, ,, less advanced.

(All except 17 magnified 40 diameters).

Plate XIV.

Fig. 1.—*Halecium gracile*, n.sp., with male gonotheca. Port Jackson. ×40.

Fig. 2.— ,, ,, Port Stephens. ×40.

Fig. 3.— ,, ,, female gonotheca. ×40.

Fig. 4.— ,, *parvulum*, n.sp. Bondi. ×40.

Fig. 5.— ,, ,, with female gonotheca. ×40.

Fig. 6.—*Pasythea quadridentata*, Ellis and Sol. Bondi. ×25.

Fig. 7.— ,, ,, Coogee. ×25.

Fig. 8-9.— ,, *hexodon*, Busk. Moreton Bay. ×25.

PLATE XV.

Fig. 1.—*Sertularella indivisa*, Bale. Port Phillip.

Fig. 2.— ,, ,, Portland, Vict.

Fig. 3.— ,, *solidula*, Bale. Port Phillip.

Fig. 4.— ,, ,, Bondi.

Fig. 5-7.— ,, *variabilis*, n.sp. Port Jackson.

Fig. 8.— ,, ,, a variety with longer teeth.

Fig. 9.— ,, ,, a slender variety, with calycles nearly smooth, and directed to the front so as to show inside the aperture.

(*All magnified 40 diameters.*)

PLATE XVI.

Fig. 1-2.—*Sertularella divaricata*, Busk, var. *dubia*, n. var. Bondi.

Fig. 3-4.— ,, *divaricata*, var. *sub-dichotoma*, n. var. Port Jackson.

Fig. 5-6.— ,, *longitheca*, n.sp. Port Denison.

Fig. 7.— ,, *cylindrica*, n.sp. Port Jackson.

Fig. 8.— ,, *microgona*, v. Lend. Port Phillip. (From one of Dr. von Lendenfeld's types)

(*All magnified 40 diameters*).

PLATE XVII.

Fig. 1-2.—*Synthecium orthogonia*, Busk. Port Jackson.

Fig. 3.— ,, ,, a specimen with calycles directed towards the front.

Fig. 4.—*Synthecium orthogonia*, gonotheca, narrower aspect.

Fig. 5.— ,, ,, broader aspect.

Fig. 6-9.—*Sertularia geniculata*, n.sp. Port Jackson.

Fig. 10-11.— ,, ,, gonothecæ.

(*All magnified 40 diameters*).

PLATE XVIII.

Fig. 1-2.—*Sertularia complexa*, Clarke. Bondi. ×40.

Fig. 3-4.— ,, ,, gonothecæ. ×40.

Fig. 5.—*Thuiaria subarticulata*, Coughtrey. New Zealand. ×25.

Fig. 6-7.—*Thuiaria subarticulata*, hydrothecæ, more enlarged.

Fig. 8.— ,, ,, (= *Sertularia fertilis*, v. Lend.) with all the calycles except one broken away. ×25. (From Dr. von Lendenfeld's type).

Fig. 9-10.—*T. sinuosa*, n.sp. Port Molle. ×25.

Plate XIX.

Fig. 1-4.—*Azygoplon productum*, Bale. Various forms of hydrothecæ. ×80.

Fig. 5.— ,, ,, adnate gonotheca. ×25.

Fig. 6.—*Plumularia alata*, n.sp. ×80.

Fig. 7-10.— ,, ,, ×112.

Fig. 11.— ,, *spinulosa*, Bale, variety from Coogee. ×80.

Fig. 12-13.— ,, ,, gonothecæ. ×20.

Fig. 14.— ,, *compressa*, Bale, small variety, Botany. ×80.

Fig. 15-17.— ,, *aurita*, n.sp. Botany. ×80.

Fig. 18-19.— ,, ,, gonothecæ. ×20.

Plate XX.

Fig. 1-2.— { *Plumularia campanula*, Busk.
,, *rubra*, v. Lend.

These figures apply equally to both species.

(From Dr. von Lendenfeld's type of *P. rubra*). ×80.

Fig. 3.—*Plumularia campanula*, female gonotheca. (From Dr. von Lendenfeld's type *P. Torresia*. *P. campanula*, from Port Phillip Heads, has exactly similar gonothecæ). ×25.

Fig. 4.—*Plumularia campanula* and *P. rubra*, male gonotheca. (From Dr. von Lendenfeld's type *P. rubra*). ×25.

Fig. 5.—*Plumularia campanula* and *P. rubra*, female gonotheca. (From a N.S. Wales specimen of *P. campanula*). ×25.

Fig. 6.—*Plumularia campanula* and *P. rubra*, male gonotheca. (From same as last). ×25.

Fig. 7.—*Plumularia setaceoides*, Bale. Lax variety, with thickened cell-wall. ×80.

Fig. 8.—*Plumularia setaceoides*. Small variety, much thickened. ×80.

Fig. 9.—*Plumularia caliculata*, n.sp. Port Jackson. ×80.

Fig. 10-11.— ,, ,, Gonothecæ, front and side views. ×25.

Fig. 12-13.— ,, *turgida*, n.sp. Lyttleton, N.Z. ×80.

Fig. 14.— ,, *setacea*, Ellis. Port Phillip. ×80.

Fig. 15.— ,, ,, (From v. Lendenfeld's type *P. tripartita*). ×80.

Fig. 16.— ,, ,, Gonotheca. (Same as last). ×25.

Fig. 17-18.— ,, ,, Gonothecæ. Port Phillip. ×25.

Plate XXI.

Fig. 1-2.—*Aglaophenia sinuosa*, n.sp. Port Denison. ×80.

Fig. 3-4.— ,, *macrocarpa*, n.sp. Off Port Jackson. ×80.

Fig. 5.—*Lytocarpus Phillipinus*, Kirch. Moreton Bay. ×80.

Fig. 6-7.— ,, ,, Gonothecæ in different stages. ×20.

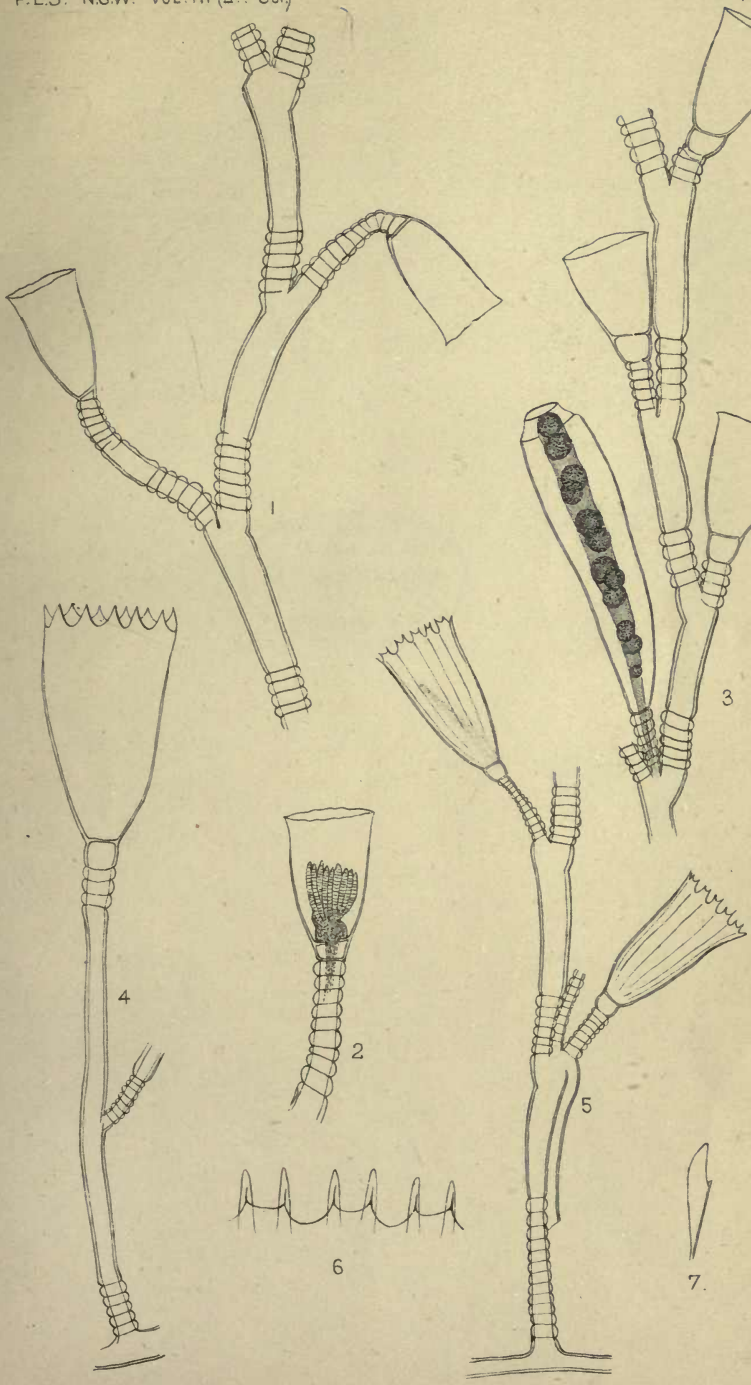
Fig. 8.—*Aglaophenia* (*?*), *Whiteleggei*, n.sp. ×80.

Fig. 9-10.— ,, *phyllocarpa*, n.sp. Port Denison. ×80.

CARBONIFEROUS AND SILURIAN FOSSILS FROM CENTRAL NEW SOUTH WALES.

By Rev. J. Milne Curran, F.G.S.

The central district of New South Wales lying between the Lower Bogan and Upper Darling, has not, up to the present, yielded any organic remains. Palæontologically speaking, it is decidedly the most barren area in the colony. No mention is made of fossils from any of its rocks in De Koninck's *Recherches*, or in the lists published by Stutchbury, Strzelecki, and Clarke, or in the valuable Reports of the Department of Mines. The latest geological maps represent part of this country as "not geologically examined," while the remainder is coloured as being occupied by granite, Silurian or Devonian rocks. The Silurian and Devonian formations are represented without doubt, but their identification has depended entirely on general lithological or petrological resemblances. In collecting materials to work out some points in the geology of this little known part of the colony, I have discovered some interesting fossils, which have been so far identified as to give a definite position to the beds containing them. As it may be a long time before I get an opportunity to make use of all the facts that have come under my notice, I may be allowed to place on record the discovery of the fossils named below. It will lend some importance to these notes to remember that over the greater portion of this part of New South Wales "accurate geology is simply impossible." There is no good topographical map in existence. The country is in great part clothed with "Mallee" scrub, and pine forests. Fossils are rare, and over long distances the bed rock is hidden by superficial deposits. There are no running streams, and no ravines to expose natural sections. I am fairly well acquainted with the country between Bourke on the north, and the "divide" of the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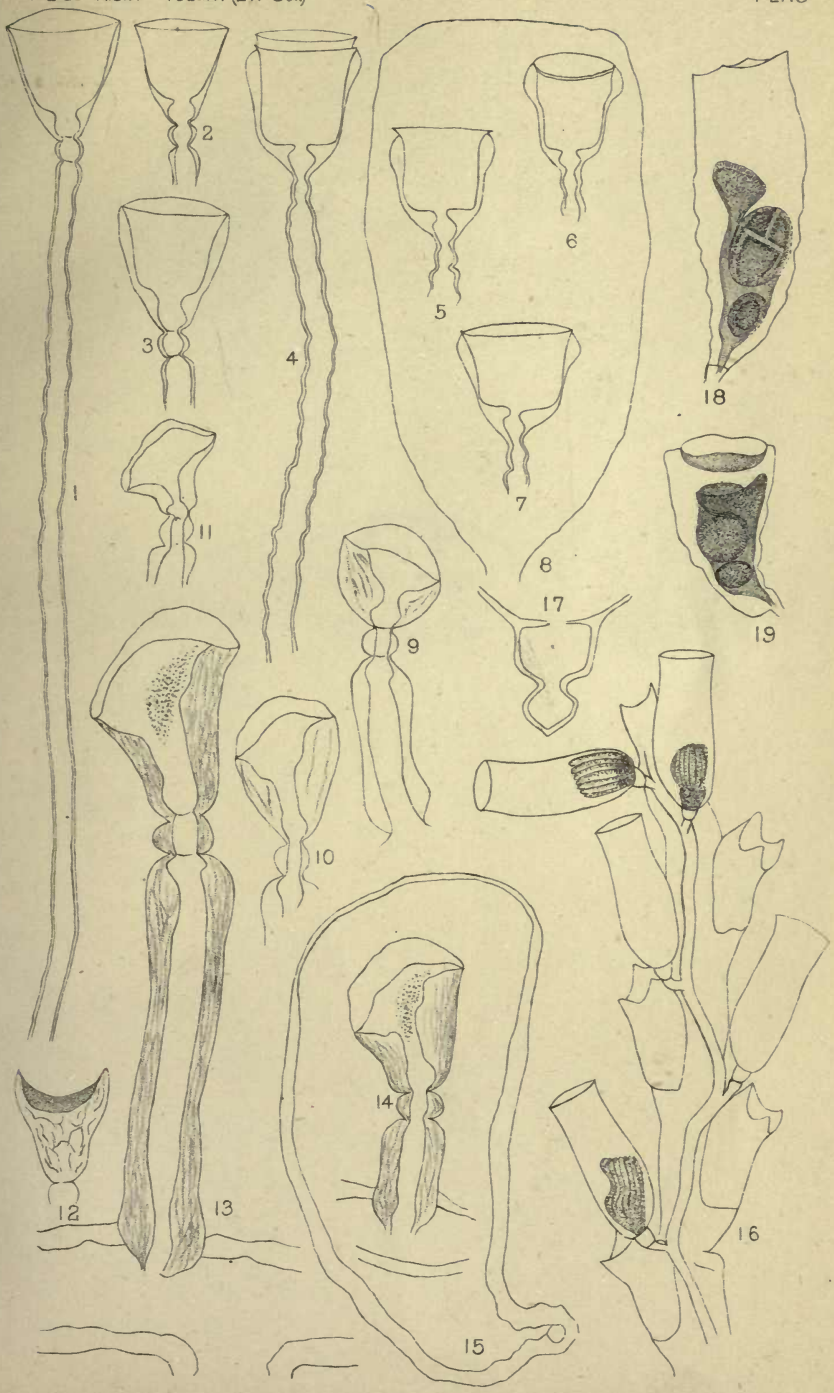
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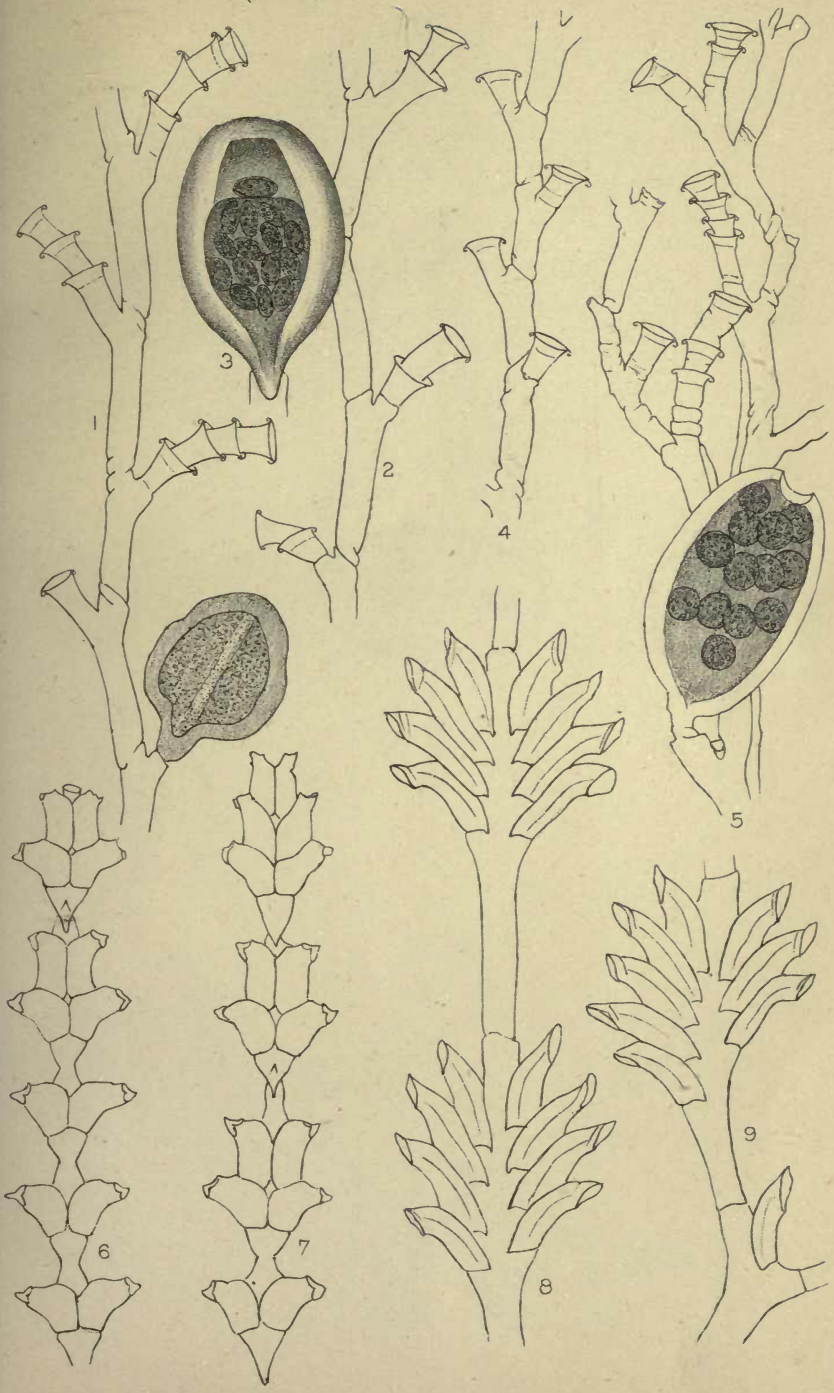
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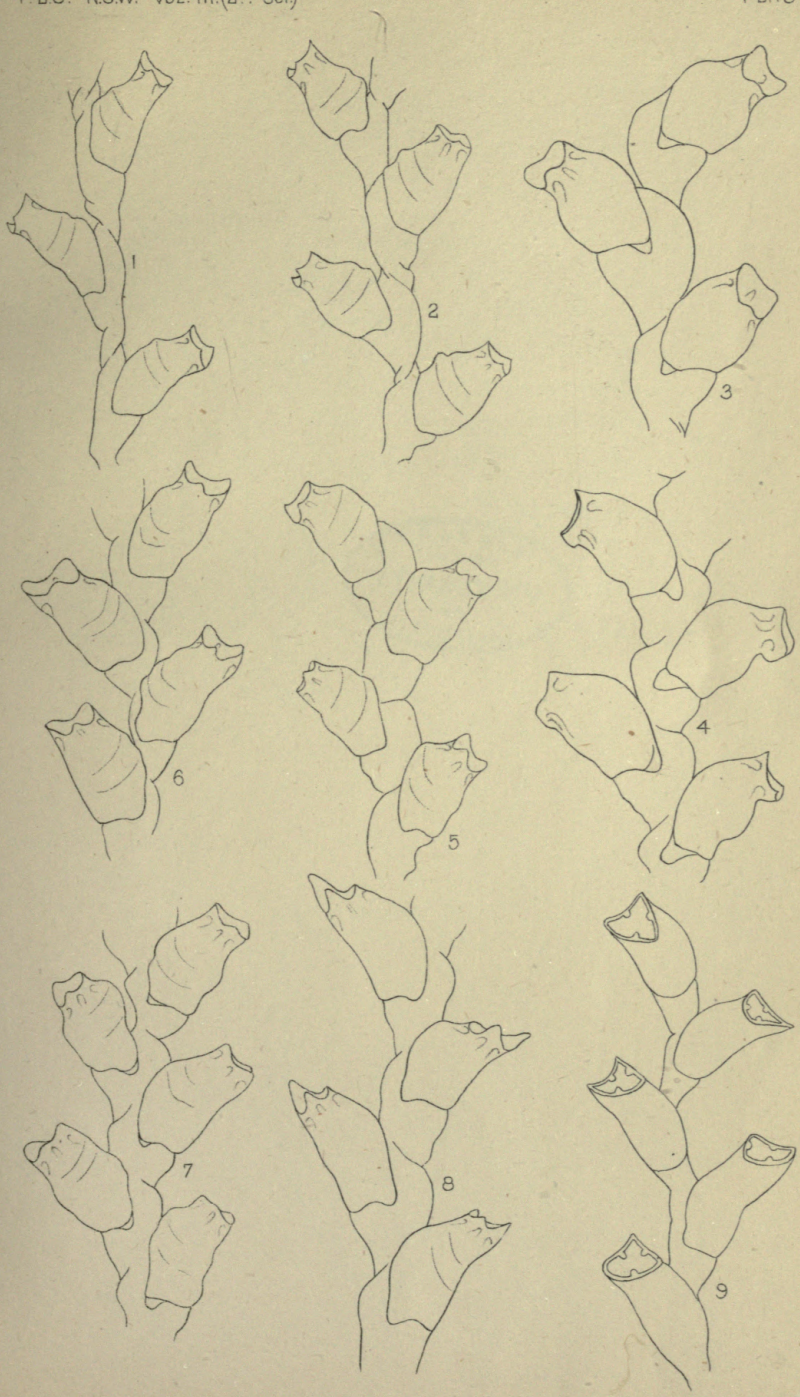
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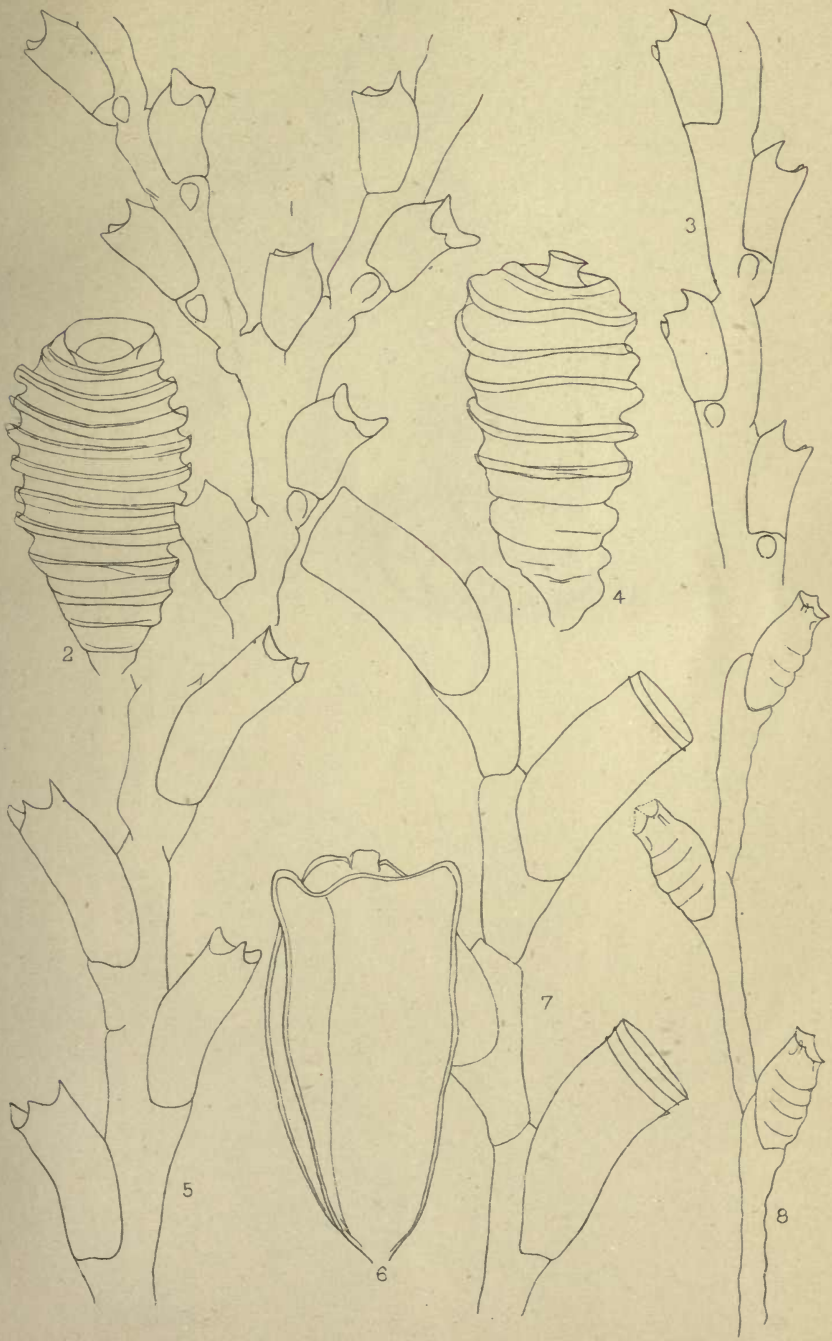
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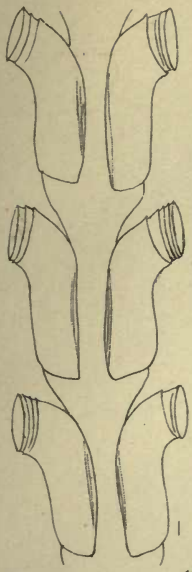
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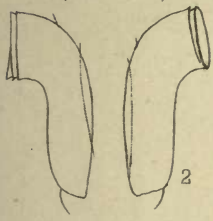
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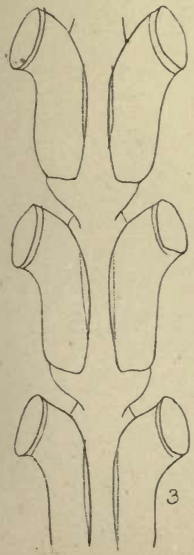
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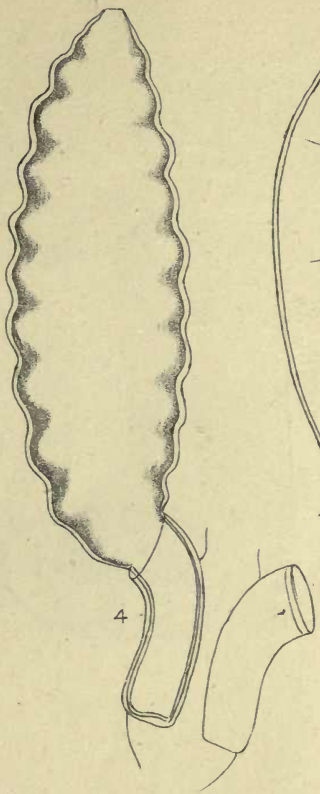
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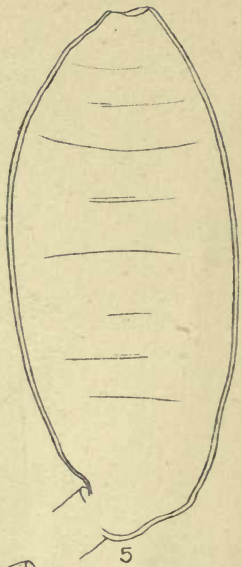
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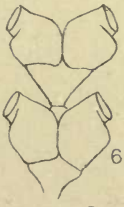
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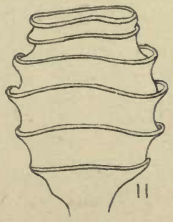
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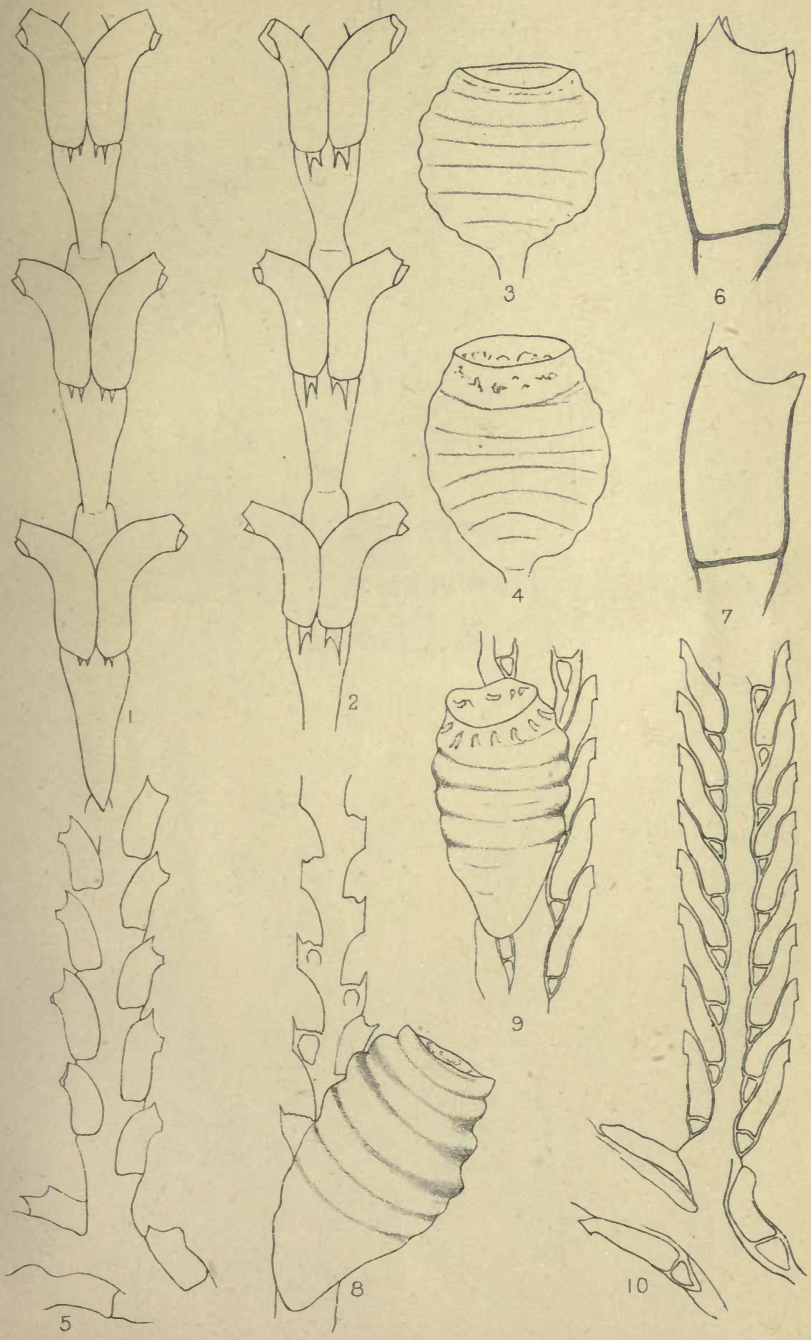
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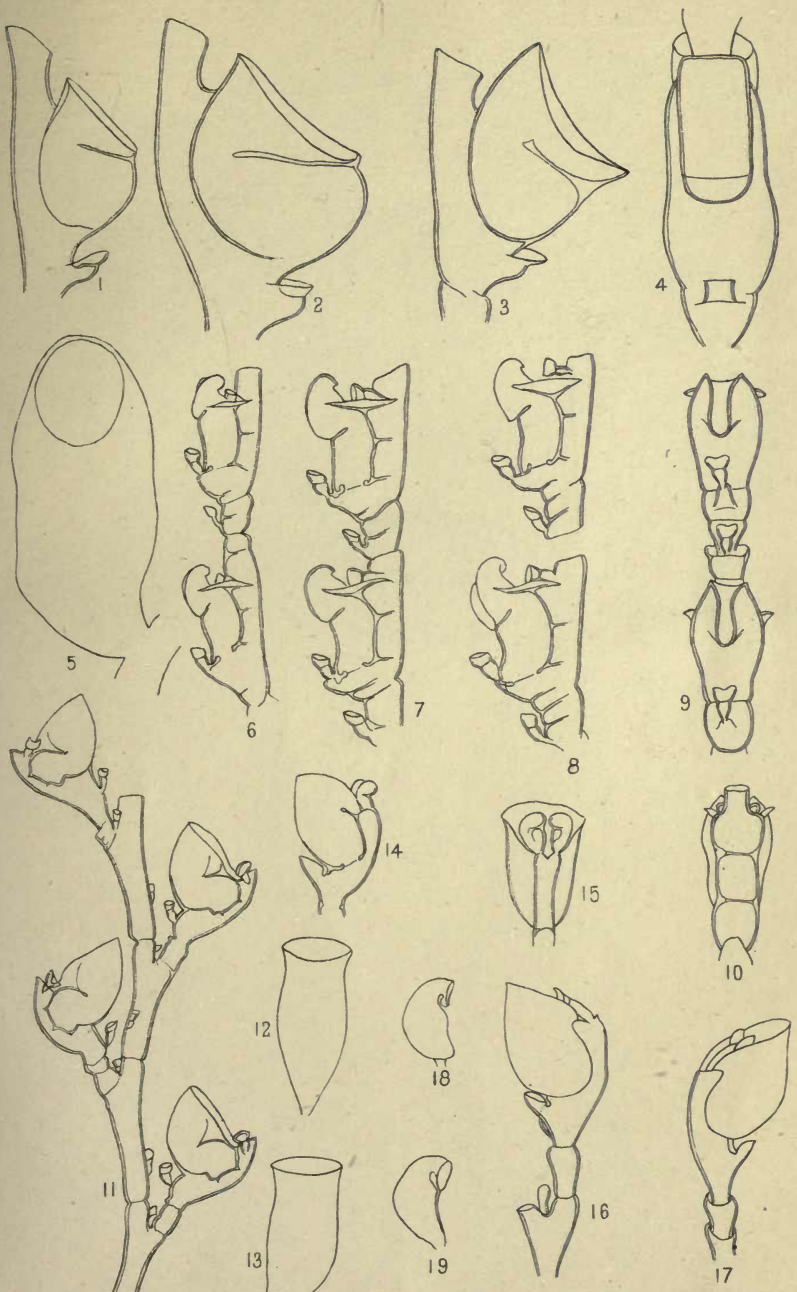
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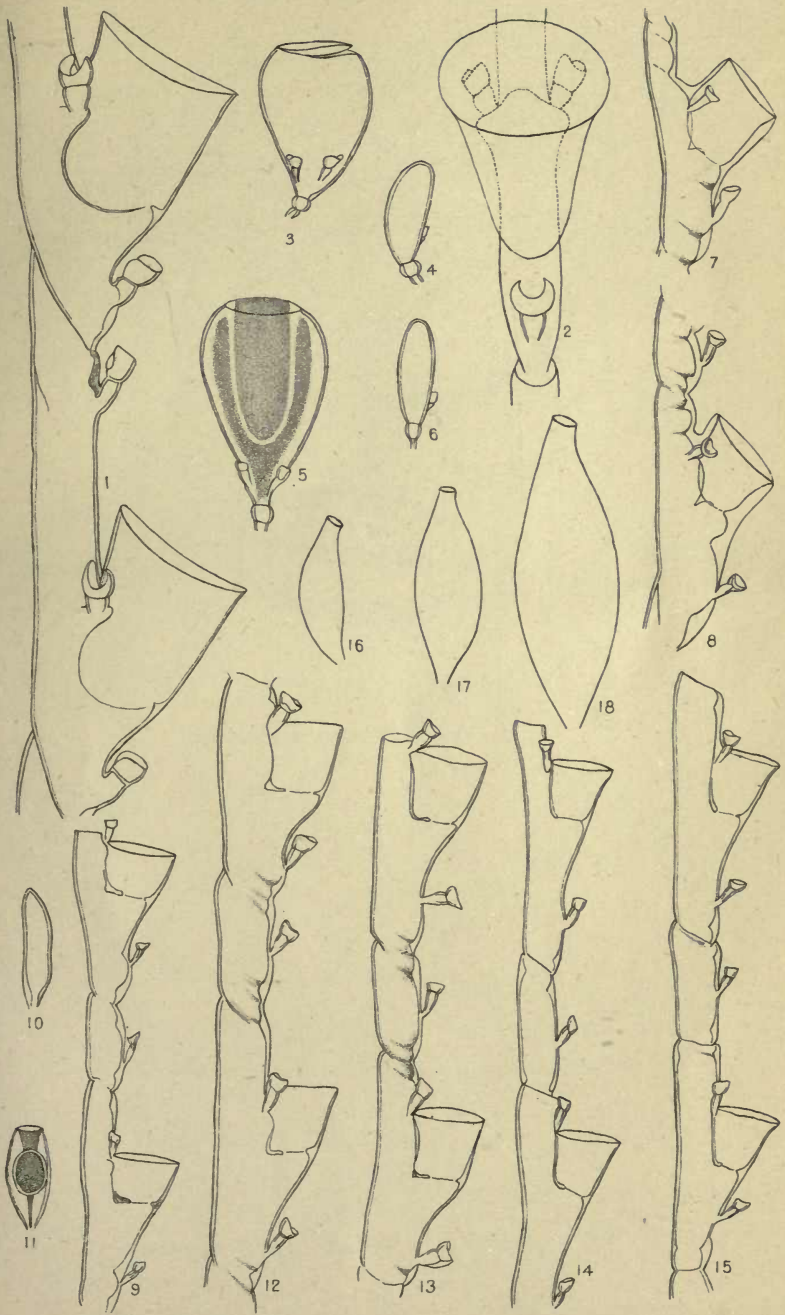
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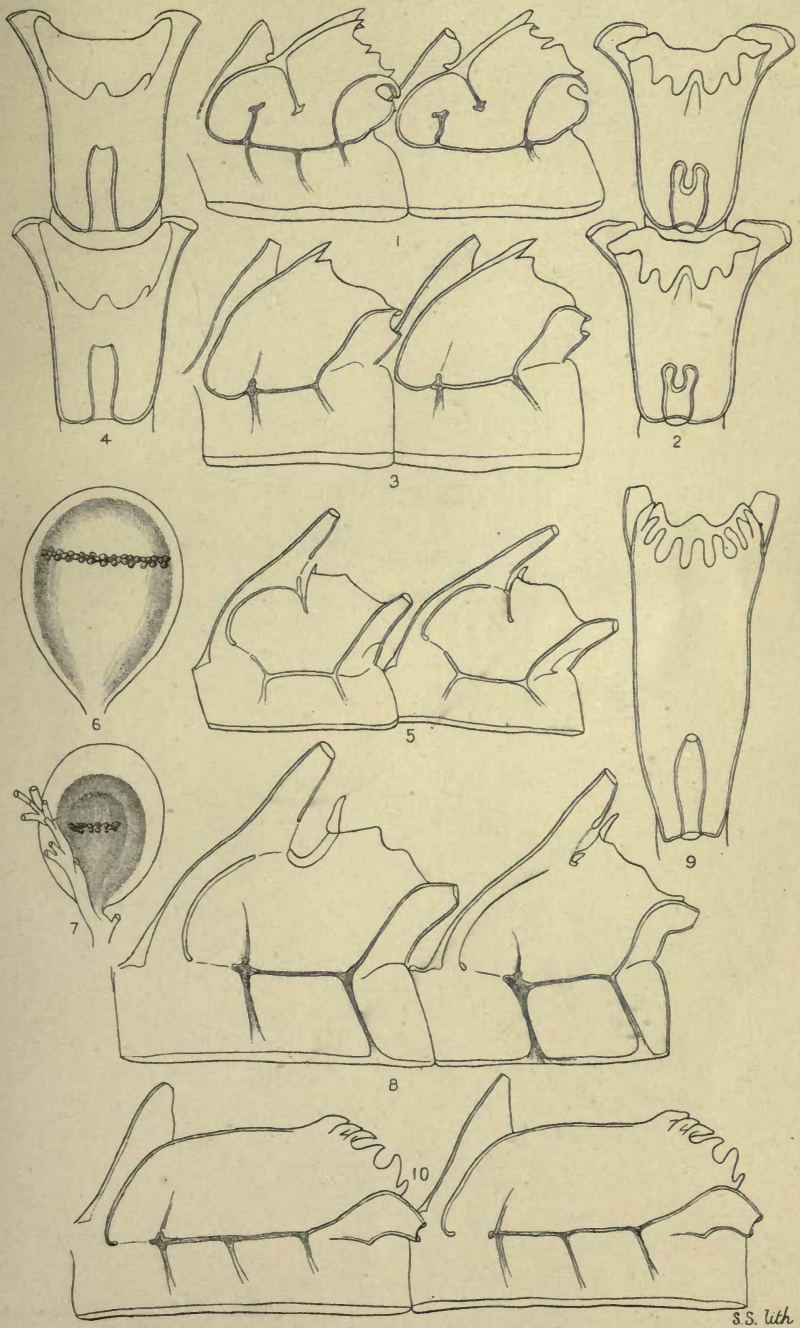
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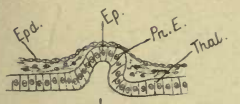
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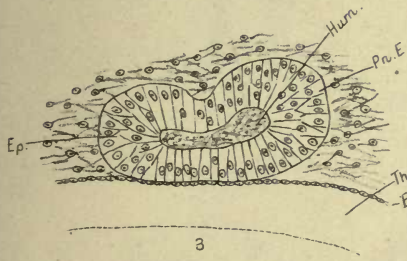
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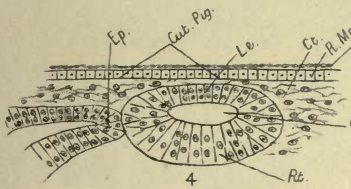
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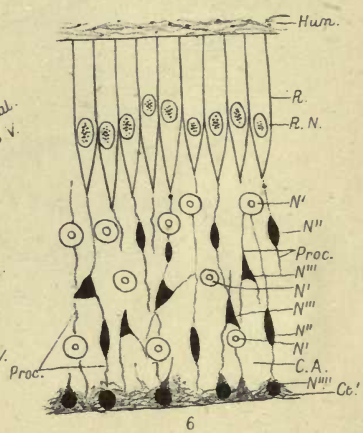
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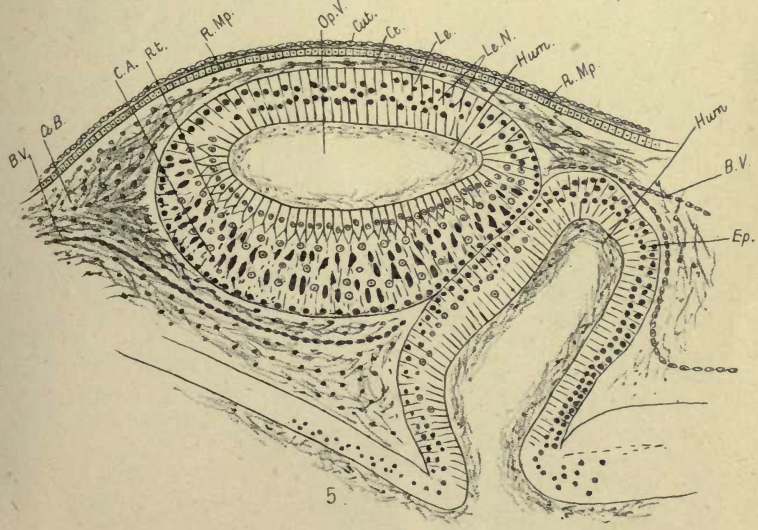
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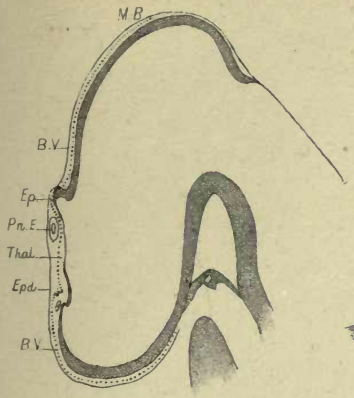

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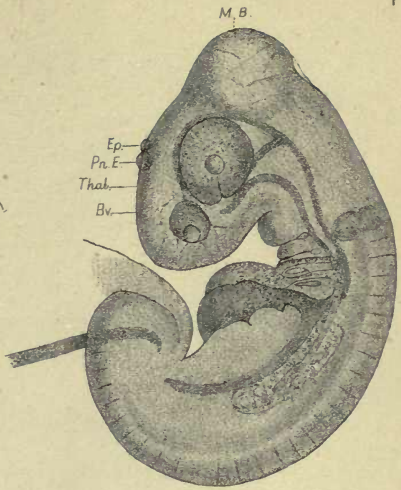

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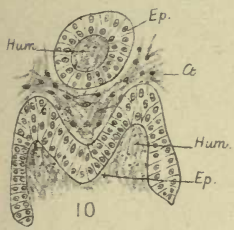

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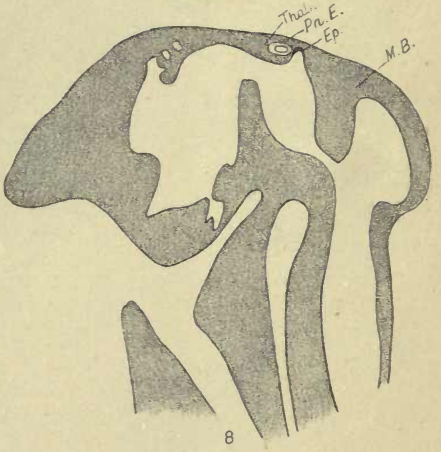

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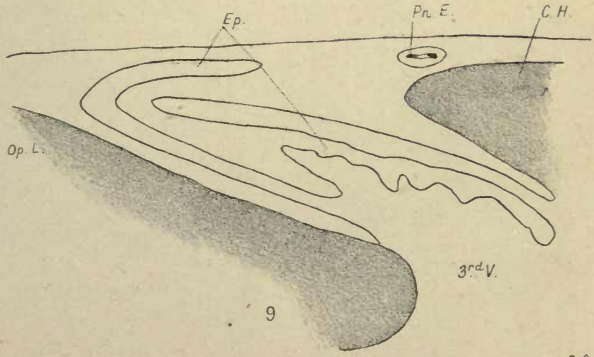

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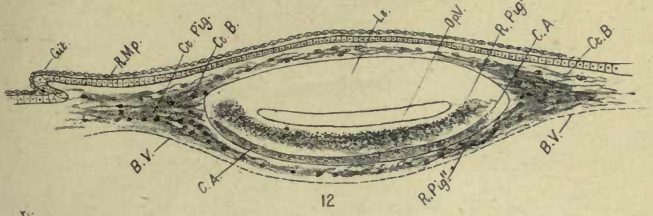

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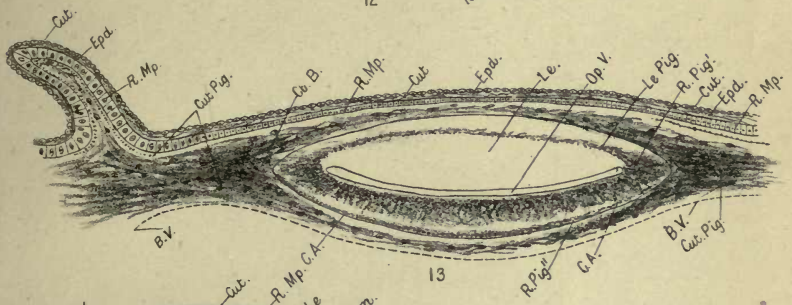

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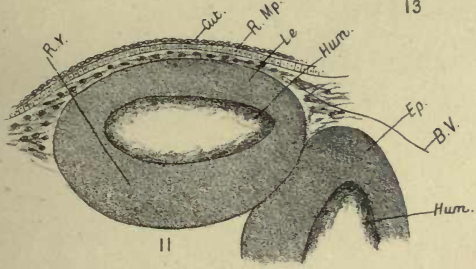

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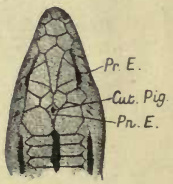

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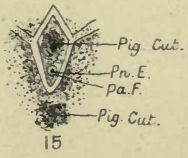

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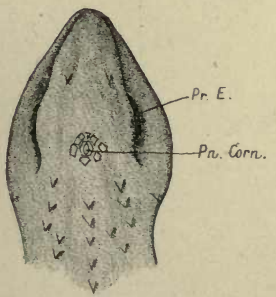

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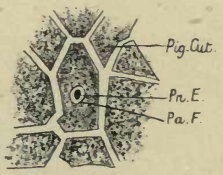

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on some new and rare
hydroida in the Australian
museum collection.